The MINING CONGRESS JOURNAL

Volume 13 NOVEMBER, 1927 *No.* 11

IN THIS ISSUE

30th Annual Convention, The American Mining Congress
Government Ownership of Industry
Proposed Plan for Rehabilitation of Hydraulic Mining

The Londonderry Colliery
Centrifugal vs. Plunger Pumps for Dewatering Mines
Safety Methods of Gallup American Coal Company
Concerning Permissible Explosives

Slime Filling for Extinguishing Mine Fires
Development of Undercut Caving Method of Mining
Engineering Features of Undercut Caving System at Miami

Reports on the Mechanization Survey

Contributors:

Roy H. Elliott, E. R. Kendall, L. M. Kuhns, Paul F. Lewis, Harold S. Duncan, A. H. Shoemaker, Felix McDonald, J. L. Johnson, A. J. McDermid, G. B. Southward.

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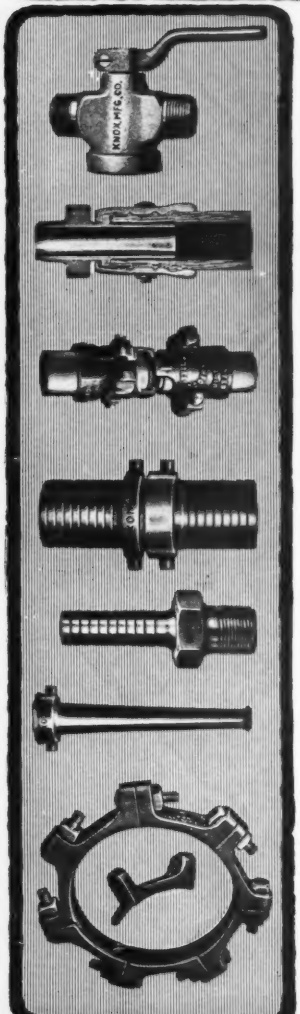

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give satisfaction

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Competition demands the best preparation possible

Over 5,000,000 *tons of medium and small sized bituminous coal, perfectly cleaned by the Arms Dry Cleaning Process will go on the market this year.*

The design and equipment for this plant were based entirely on the complete tests of the coal made in the Roberts and Schaefer Testing Plant at Harvey, Illinois. This plant is equipped with full size machinery and permits the test of carload samples of coal.

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NOVEMBER, 1927 CONTENTS $3.00 Per Year 30c Per Copy

EDITORIALS

The Convention 807
Commission Settlements 807
Mine Depletion 807
Mining and National Prosperity 808
Who Owns the Railroads 808
Big Business 809
Petroleum Waste 809
Doctrine of Statistics 809
The Illinois Truce 810
Increasing Interest in Safety 810

FEATURE ARTICLES

Thirtieth Annual Convention of The American Mining Congress 811
Government Ownership of Industry 815
A Proposed Plan for the Rehabilitation of Hydraulic Mining—By Roy H. Elliott 817
Reports on the Mechanization Survey—By G. B. Southward 821
The Londonderry Colliery, Durham, England 826
Centrifugal vs. Plunger Pumps for Dewatering Mines—By E. R. Kendall 828
Safety Methods of the Gallup American Coal Company—By L. M. Kuhns 829
Concerning Permissible Explosives—By Paul F. Lewis 832
Slime Filling for Extinguishing Mine Fires—By Harold S. Duncan and A. H. Shoemaker 834
History of the Development of the Undercut Caving Method of Mining—By Felix McDonald and J. L. Johnson 835
Engineering Features of the Undercut Caving System of Mining as Applied by the Miami Copper Company—By A. J. McDermid 839

DEPARTMENTS

REPORTS ON THE MECHANIZATION SURVEY 821
PRACTICAL OPERATING MEN'S DEPARTMENT, COAL 826
PRACTICAL OPERATING MEN'S DEPARTMENT, METALS 834
THE NATION'S VIEWPOINT 851
NEWS OF THE MINING FIELD 856
WITH THE MANUFACTURERS 866

NEWS

International Fuel Conference 833
Treasury Department Files Answer to Silver Producers Suit 849
Mining Exhibit at Utah Fair Successful 850
New Topographical Map of Area in Pennsylvania 855
Arizona Chapter Holds Successful Meeting 856
Production of Gold, Silver, Copper, Lead and Zinc in Nevada 856
Copper and Brass Research Association 857
Mining Exhibit to be Feature of Arizona State Fair 858
Underground Power Transmission 859
Briefs Filed in Fluorspar Tariff Case 859
Department of Commerce Coordinates Minerals and Metals Services 860
Radio Prospecting Experiments 860
Coal Engineers Discuss Mechanical Loading 861
Our Export Coal Trade 863
Oil Shale Discovery Defined 865

PRACTICAL OPERATING MEN'S DEPARTMENT

COAL

The Londonderry Colliery, Durham, England
Centrifugal vs. Plunger Pumps for Dewatering Mines
Safety Methods of the Gallup American Coal Company
Concerning Permissible Explosives

METALS

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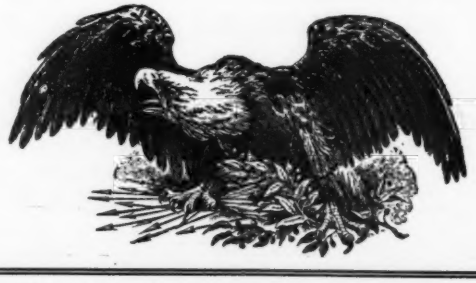

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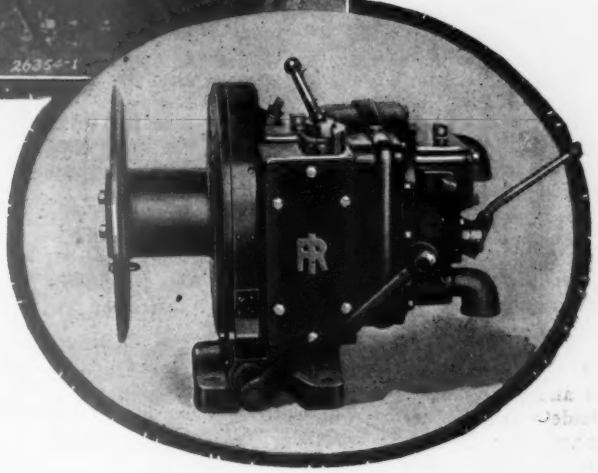
The "Little Tugger" In Underground Hoisting

IN every mine there is work for the "Little Tugger" to do.

In winzes, inclines, stopes, and raises, the "Little Tugger" is used for the up and down handling of tools, timber, steel, rock drills, hoses, etc. On these operations it saves time, labor, and money.

"Little Tuggers" are rugged and light, and are easy to move around and set up. They are powerful, economical, and safe.

All these hoists are equipped with ample brakes and a positive clutch. Moreover, the throttle cuts off automatically when released and cannot be started unintentionally.



This 9H "LITTLE TUGGER" has an outboard bearing drum, facilitating rope changes. Weighing only 275 lbs., it hoists 2000 lbs. at 125 ft. per minute on 80 lbs. air pressure.

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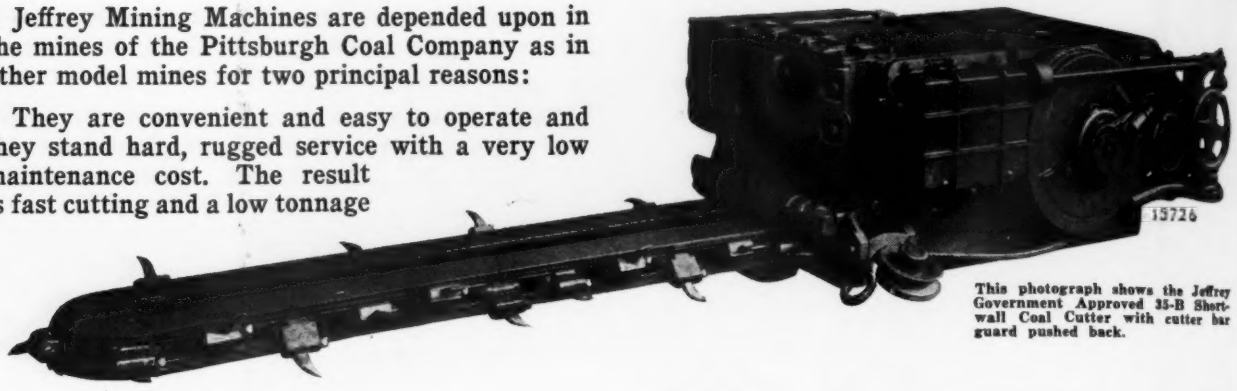
Jeffrey Equipment at the PITTSBURGH COAL *includes* 95% of the Mining

Jeffrey Mining Machines are depended upon in the mines of the Pittsburgh Coal Company as in other model mines for two principal reasons:

They are convenient and easy to operate and they stand hard, rugged service with a very low maintenance cost. The result is fast cutting and a low tonnage



This photograph shows the Jeffrey Government Approved 35-B Shortwall Coal Cutter with cutter bar guard pushed back.

107 Locomotives

The 107 Jeffrey Locomotives in service in the Pittsburgh Coal Company mines comprise more than 50% of their locomotives' tonnage (Haulage, Gathering, and Storage Battery).

Jeffrey Armorplate Haulage Locomotives are built in 8, 10, 13, 15, 25 and 30 ton sizes. All wearing surfaces are renewable, and all adjustments such as adjustments for break shoe wear and all points of lubrication are easily accessible.

Jeffrey Cable Reel Gathering Locomotives are built in 4 and 6 tons sizes, low and standard types, inside or outside wheels. These locomotives are built with either mechanically driven or motor driven horizontal cable reels, or vertical floating type reel.

Jeffrey Gathering Battery Locomotives are built in 6,000 lb., 8,000 lb., and 10,000 lb. chassis and battery capacities up to 56 kilowatt hours. The Haulage Battery Locomotives are furnished in sizes from 20,000 to 26,000 lb. chassis with batteries of correspondingly larger capacity.

Special features of Jeffrey Locomotives include:

Improved Journal Box fitted with long flexible springs.

Special Cast Alloy Iron Grid Resistance.

Heavy Duty Controllers or Contactors.

Ball Bearing Motors (Standard on Jeffrey Locomotives for 17 years).

The Jeffrey Manufacturing Company

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Sales and Service Stations: Birmingham, 26 South 20th St. Winchester, Ky., 122 N. Main St. Salt Lake City, 153 W. Second South St.

JEFFREY

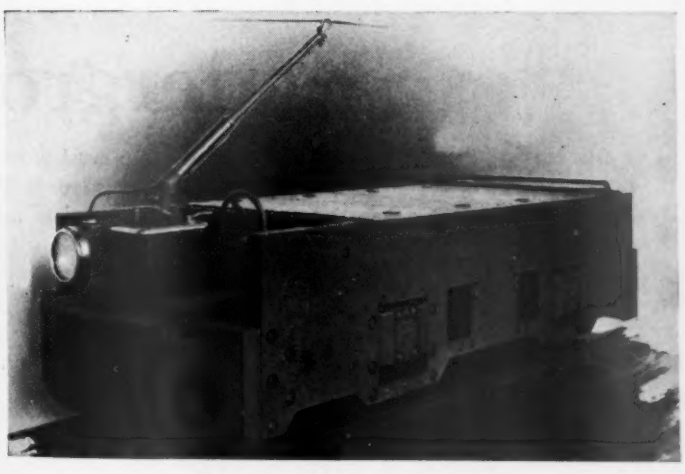
COMPANY

ning Machines

cost. Features that have made this government approved 35-B Shortwall Coal Cutter popular in Pittsburgh Coal Company mines are:

- Comparatively light, but powerful construction.
- Conveniently grouped control mechanism, for easy operation.
- Feed and Handling Drums power driven simultaneously each with its own multiple disc clutch.
- Simplified gearing design which minimizes breakdown liability.
- Easily and quickly repaired.
- Narrow Cutter Bar and Bottom Pan permit machine to automatically follow bottom.
- Handi-Truck for quick loading and unloading of machine.

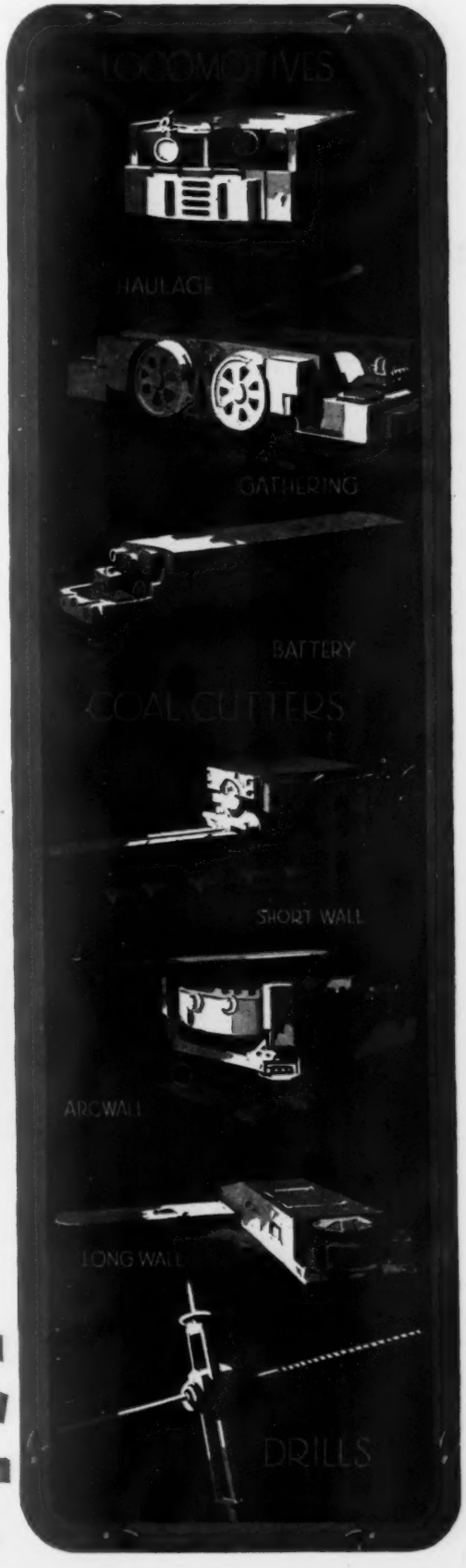
tives



Jeffrey Armorplate Haulage Locomotive

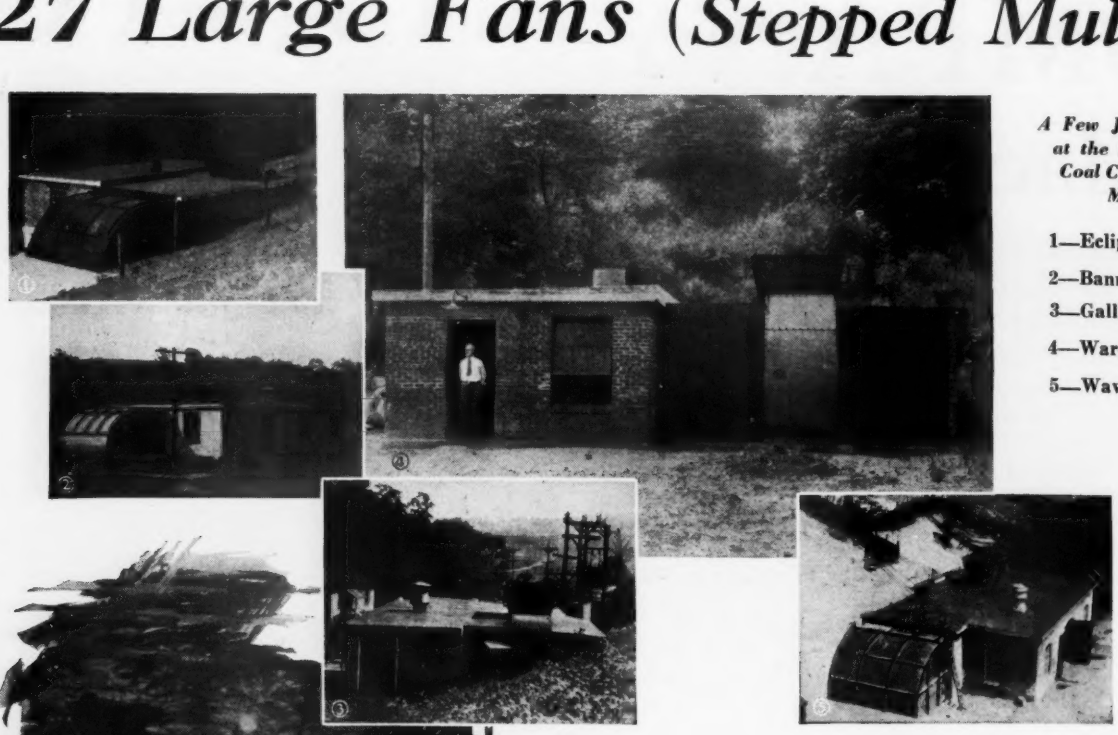
Denver Charleston, W. Va. Salt Lake City Montreal, Canada
Pittsburgh, 600 Second Ave. Scranton, 122 Adams Ave. Terre Haute, Ind., 319 Cherry St.

Y COAL MINE EQUIPMENT



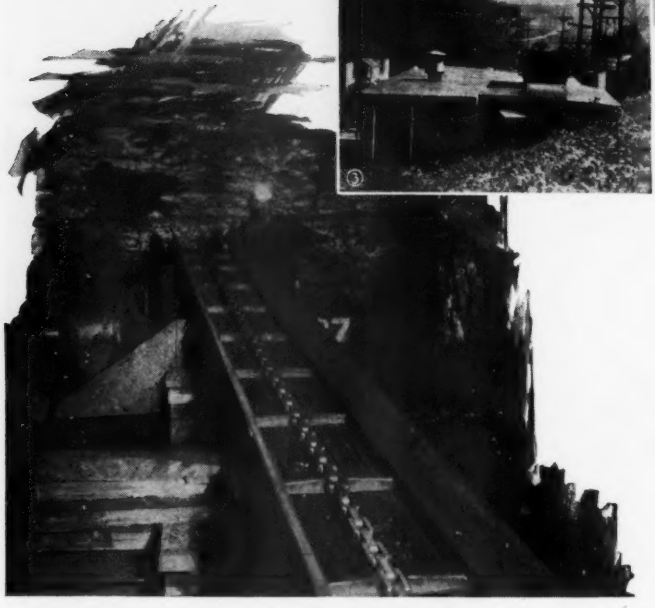
Jeffrey Equipment at the Pittsburgh Coal Co mp

27 Large Fans (Stepped Multi-Bl ad



A Few Jeffrey Fans at the Pittsburgh Coal Company's Mines

1—Eclipse
2—Banning No. 3
3—Gallatin
4—Warden
5—Waverly



Undergrou nd

This 47-A Jeffrey Sectional Conveyor is used to take coal away from the working face. The conveyor is 200 ft. long and takes the coal direct from the face and empties it into the pit cars.

Details of this conveyor are:

Length of section	6 ft.
Height to bottom of trough	3 in.
Height overall	11½ in.
Width overall	25 in.
Weight of heaviest part of section	150 lbs.

The Jeffrey Manufacturing Company

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Sales and Service Stations: Birmingham, 26 South 20th St. Winchester, Ky., 122 N. Main St. Salt Lake City, 153 W. Second South St.

JEFFREY

Co*mpany continued*

Bl*aded and Straitflo)*

Fans are the lungs of the mine and it is vital to have safe and dependable ventilation. The men must have fresh air at all times. Likewise the gases must be carried off quickly to minimize any possibility of explosions. Jeffrey Fans not only provide safe ventilation but also cut power bills materially.

The best proof of Jeffrey fan efficiency is in repeat orders. As many as 70 fans have been sold and installed by one mining company. Several others have slightly less than this number. The Pittsburgh Coal Company has twenty-seven large Jeffrey fans and also many of the small ones. All the fans more than 8 ft. are Jeffrey.

STEPPED MULTI-BLADED MINE FAN—The stepped series of blades and ample sizes permit handling air at low velocities, cutting power bills 10% to 30%. Capacities of 10,000 C.F.M. to 600,000 C.F.M. Catalog No. 280-H.

STRAITFLO FAN—Used for ventilating small mines, developing larger ones, and also used for boosting purposes. Bulletin No. 348-H.

UNIVERSAL BLOWERS—For use with flexible tubing in ventilating dead ends, entries, etc. Bulletin No. 408-E.

ou*nd* Conveyors

A most important advantage is that a section can be added or taken out quickly. There is no slipping and spilling of coal where the conveyor must operate on an incline. The coal is moved with a steady even pull from face to car.

The sectional conveyor is just one of the Jeffrey equipments that are helping to solve the problem of concentrated mining. Let us give you complete details of all of the Jeffrey Units for Concentrated Mining.

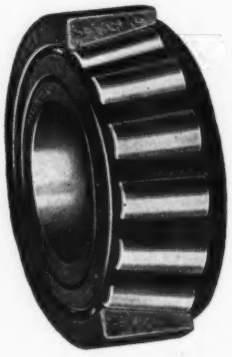
Complete information on any of these Jeffrey Mining Equipments will be sent on request

Denver Charleston, W. Va. Salt Lake City Montreal, Canada
Pittsburgh, 600 Second Ave. Scranton, 122 Adams Ave. Terre Haute, Ind., 319 Cherry St.

Y COAL MINE EQUIPMENT

What Link-Belt Says About Timken Bearings

Why We Use Timken Anti-Friction Bearings



JUST as any structure to be secure must rest upon a firm base, so a successful conveyor idler must be built upon a substantial bearing. The efficiency of the idler, more than any other one thing, determines the service given by the conveyor. For this reason we use the best bearing for a belt conveyor idler—namely, Timken Tapered Roller Bearings.

The durability of Timken Bearings has been thoroughly proved in many fields, notably the automobile industry. In automobile front wheels, these bearings operate under similar conditions but more severe than that which is imposed upon bearings mounted in belt conveyor idlers. We use as large bearings as are found in many automobile front wheels, yet the diameter of idler rolls (and consequent shock in belt conveyor service) is very much less than that of the automobile wheels.

Belt conveyor service demands a bearing that will carry both heavy radial and thrust loads, on an anti-friction basis. At the same time, the bearings must run with very little attention year in and year out. The fact that Timken Tapered Roller Bearings have successfully demonstrated their ability to meet these requirements is our reason for using them exclusively in Link-Belt Anti-Friction Belt Conveyors.

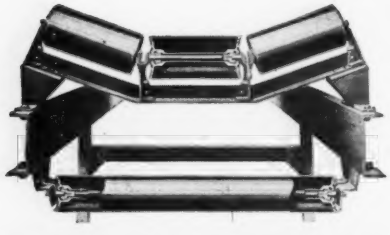
LINK-BELT

67

Reproduction of Page 67 of the new 144-page Data Book published by the Link-Belt Company

NEVER in the history of Belt Conveyor construction has there been so strong an endorsement of Timken Tapered Roller Bearings. Years of experience under every condition of hard service have satisfied Link-Belt Company that no other type of bearing is sturdy and rigid enough for this extremely hard service.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO



TIMKEN *Tapered Roller* BEARINGS

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The Rope That Lasts

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The Type F Coloder

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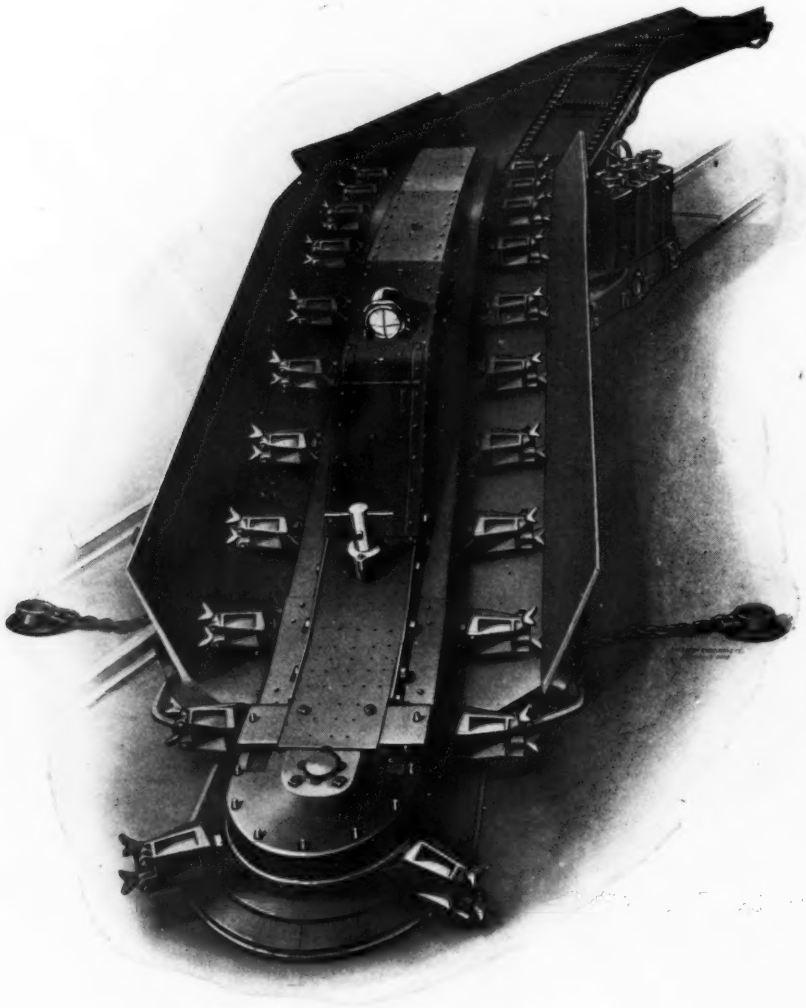


THE COLODER COMPANY, Columbus, O.

The COLODER

Costs of coal production are too high. Means are available to reduce them.

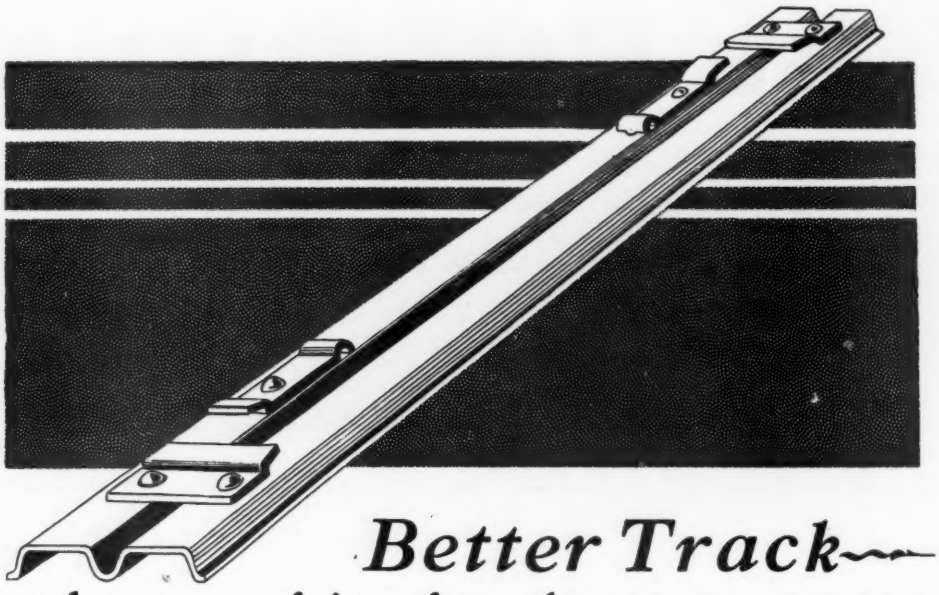
Your man day tonnage, if you load coal by hand, is too low. The primary index of mine cost in any field is man day tonnage, irrespective of wage rates.

COLODERS increase man day tonnage and net revenue. COLODERS make their appeal only to those who are serious in their desire to reduce costs.

COLODERS are efficient, reliable and sturdy; easy to operate and economical to maintain.

COLODERS stay on the track and they stay on the job, too.

THE COLODER COMPANY, Columbus, Ohio

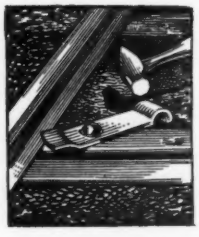


Better Track—

and more of it---for the same money

There are two ways of buying mine ties. One way is to consider first cost only. The efficient buyer, however, considers unit cost—the cost per foot per year. And the efficient buyer has found from experience that steel ties give him better track at a lower unit cost, than wood ties.

Carnegie Mine Ties are made of copper steel. Wood ties rot. Ordinary steel ties rust. The copper content of Carnegie Ties greatly retards corrosion, thus assuring a much longer period of usefulness.



Recent improvements in Carnegie Ties increase their efficiency. Through better distribution of metal, the new sections have greater strength without increase in weight. The outside fastening has also been redesigned to eliminate any tendency of the rail pushing under the clip.

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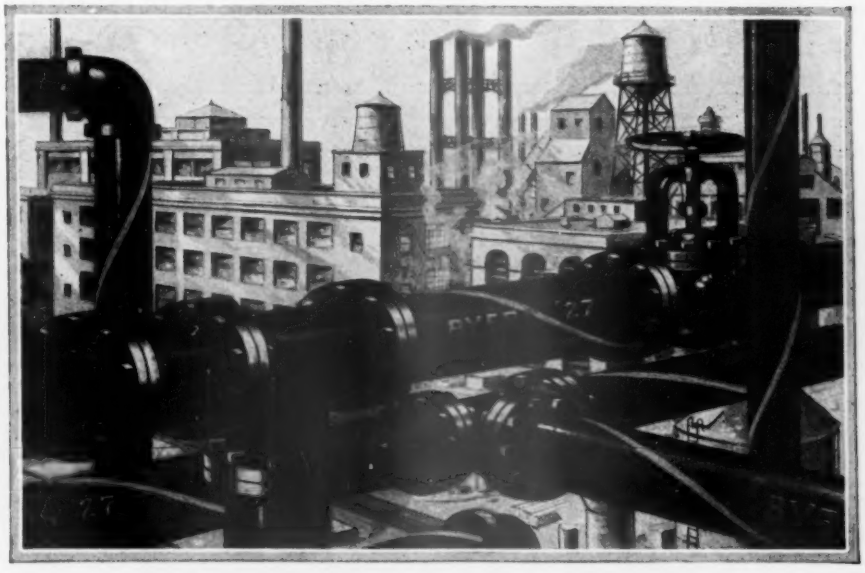
1888



"We Did a Little Anti-Corrosion Engineering of Our Own"

"FOR the parts of our main plant where it could be made to serve," said the Chief Engineer, "we installed anti-corrosion equipment—the best we could obtain—at a cost of $50,000. We found it did not do away with corrosion altogether, but did lessen it materially, in the parts of the pipe system to which the treatment could be applied.

"The pipes that still gave trouble, in spite of the treatment, were mostly of small sizes, two inches and under.

"Then we began to reason. If it is worth while to spend $50,000 on part of the plant, in order to avoid pipe failures, it is certainly worth while to spend a few hundred dollars extra on rust resisting pipe, wherever corrosion continues to be a menace.

"We decided to specify Byers genuine wrought iron for all lines of two-inch diameter or less, and on larger sizes to discriminate as we have done for years.

"For small sizes—Byers only and always. On small pipe, it's too difficult to discriminate and guard against careless substitution. The extra cost of Byers is trifling.

"For large sizes—Byers in the parts of the system where corrosion is known to be severe.

"Now we feel that our corrosion troubles have been reduced to a minimum. The slightly higher cost for pipe is negligible, in view of the protection it affords."

The official quoted is connected with a large public service corporation. Further particulars on request.

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Some Hercules Products

Hercules Specials are among the most important of the improved Hercules explosives. They have effected savings as high as 30%.

Hercules Electric Blasting Caps are made in two strengths, Nos. 6 and 8. They are dependable and have several distinctive features.

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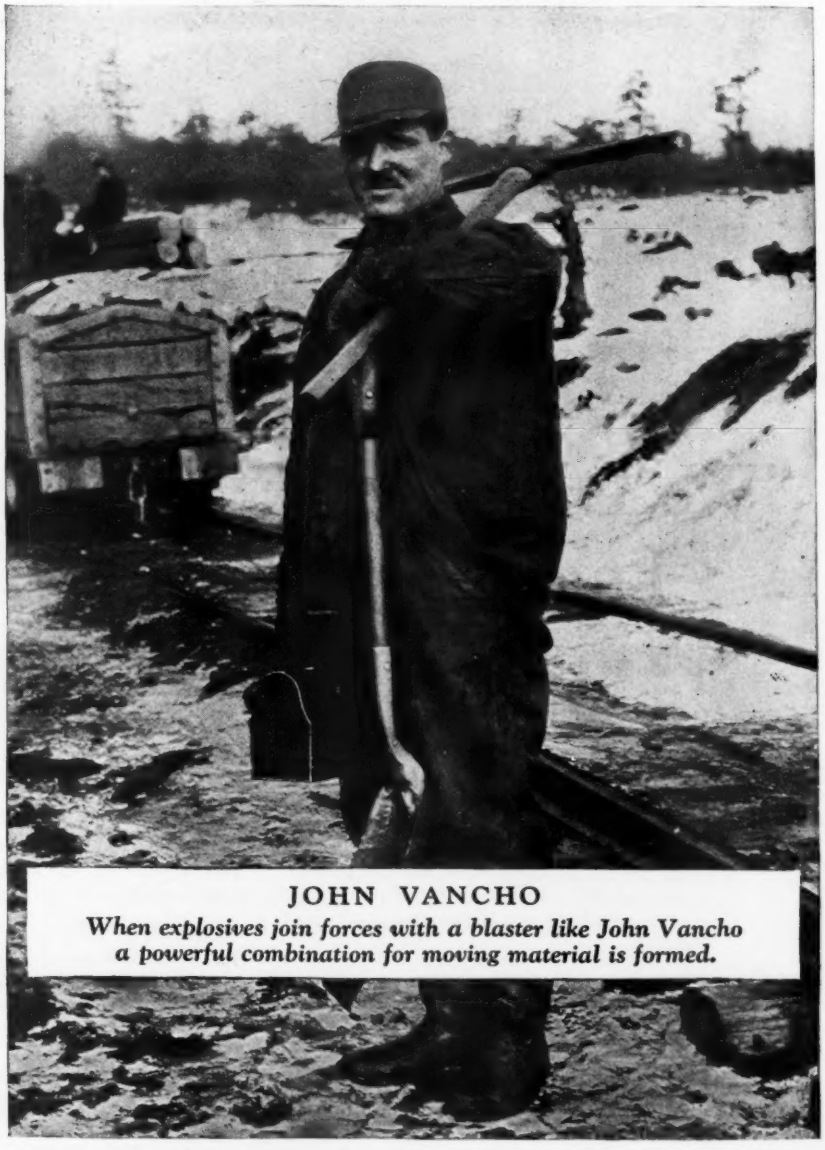

JOHN VANCHO

When explosives join forces with a blaster like John Vancho a powerful combination for moving material is formed.

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Dynamite—Permissible Explosives—Blasting Powder—Blasting Supplies

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This booklet is a handbook rather than a catalog, for the information contained is of practical value to the man on the job. It includes wiring diagrams to illustrate the various methods of connecting electric blasting caps, and presents examples and formulae for determining the voltage required to fire the various types of circuits.

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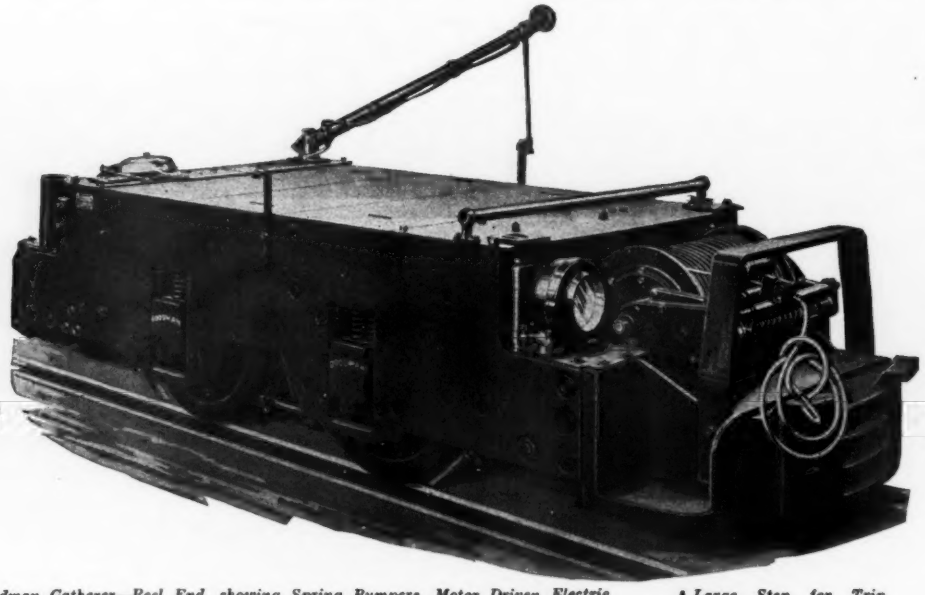
A STEP AHEAD!



A Goodman Gatherer—Reel End, showing Spring Bumpers, Motor Driven Electric Cable Reel, Guard for Reel, Hand Rail, Spring, Supported Headlights, Ball-bearing Trolley Pole, and Cut-away Side Plates.

Large Step for Trip Rider, cast into End Frame.

It'll Pay You to Weigh this Truth in Your Selection of a Locomotive:

"THE TOOL MUST BE RIGHT FOR THE WORK TO BE DONE"

To get the results You have a right to expect, the *Right* locomotive must fulfill two definite requirements:

First—Endurance and satisfactory performance under the rigorous conditions of mine service.

Second—Suitability for the particular duties to which it is to be assigned—a matter of type, weight, equipment, etc.

Goodman Mine Locomotives have been developed over a period of 36 Years to fulfill these two very definite requirements.

Have You Investigated *Closely* Their Construction?

Every Part Built by Goodman

(67)

GOODMAN MANUFACTURING COMPANY
HALSTED ST. at 48TH
CHICAGO---ILL.

Locomotives - Loaders - Coal Cutters

PITTSBURGH - CHARLESTON, W.VA. - HUNTINGTON, W.VA. - CINCINNATI - BIRMINGHAM - ST. LOUIS - DENVER - PRICE, UTAH

to Aid you

IN ALMOST every plant may be found a unit or a group of machines that constitutes a lubricating problem. You may have such a problem. It may be in the power plant, in the shafts and drives by which power is transmitted, or elsewhere. The operator in charge may be an expert in his line, yet he can hardly be expected to have the necessary time to solve difficult lubricating problems.

To assist you in such problems, the Standard Oil Company (Indiana) maintains a staff of lubricating engineers, who are being called more and more to consult with progressive concerns.

These men are competent and willing to make a survey of your plant, as they are doing in hundreds of others, and submit a report with recommendations for securing lower operating costs through correct lubrication.

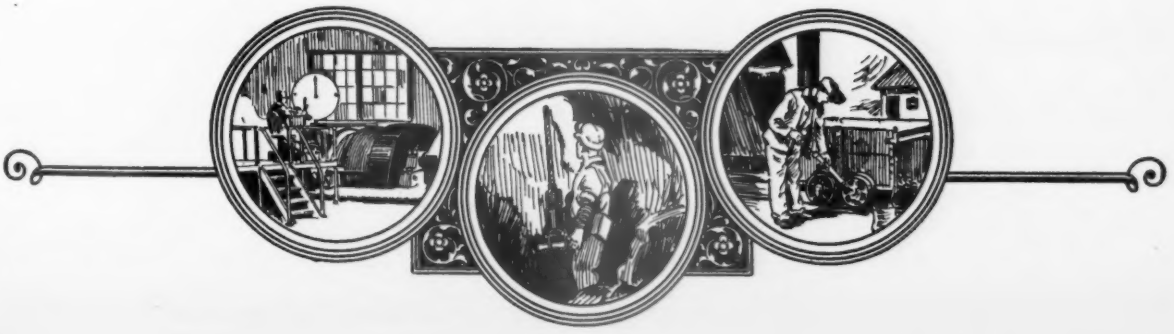
A phone call or letter directed to our nearest branch will bring you one of these lubrication engineers.

With Standard Oils and Greases Goes Standard Oil Service

The Standard Oil Company (Indiana) has branch offices and warehouses in practically every town in the ten midwestern states which comprise its territory. These warehouses serve as distributing points for you and carry your supplies of oil and grease in stock. Our trucks deliver the lubricants in iron barrels to your shops as they are needed, and pick up the empties without extra charge. As there is a Standard Oil warehouse in your town or near enough to it to give you delivery service, it is necessary for you to have on hand only enough lubricants to keep you going from week to week, thus effecting for you many important economies in handling, storage space and insurance.

STANDARD OIL COMPANY
(Indiana)

910 South Michigan Avenue Chicago, Illinois



That charge of

UNION CARBIDE

A LAMP charged with Union Carbide is the miner's best insurance of uniformly bright working light. That is so because the product is manufactured under the most rigid control.

In every one of the Union Carbide plants the quality of the carbide is rigidly safeguarded. Selected raw materials are used throughout and the product is tested at every stage of its manufacture.

The makers of Union Carbide have been identified with carbide manufacture since its commercial discovery. They are qualified to meet the miner's lighting needs.

UNION CARBIDE SALES COMPANY

Unit of Union Carbide and Carbon Corporation

UCC

Carbide and Carbon Building, 30 East 42d Street, New York

Peoples Gas Building, Chicago, Ill. *Adam Grant Building*, San Francisco, Cal.

UNION CARBIDE WAREHOUSES IN 190 CITIES

Union Carbide Sales Company's Warehouses

Shipments always made on day orders are received

ALABAMA
Birmingham....2329 First Ave. N.
Mobile....16 S. Commerce St.
Montgomery....N. Lawrence and Randolph Sts.

ARIZONA
Phoenix....42 S. Central Ave.

ARKANSAS
Ft. Smith....201 Rogers Ave.
Little Rock....1400 E. 6th St.

CALIFORNIA
Fresno....932 H St.
Los Angeles....639 Gibbon St.
Oakland....21 Madison St.
Sacramento....1717 Third St.
San Diego....301 Fourth St.
San Francisco, Adam Grant Bldg.. 114 Sansome St.
Stockton....748 S. Union St.
Taft....130 Center St.

COLORADO
Denver....Nineteenth and Wazee Sts.
Grand Junction....433 South Ave.

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East Hartford....225 Prospect Ave.

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Danville....511 Oak St.
Decatur....133 W. William St.
East St. Louis....700 Broadway
Eldorado....856 S. Fourth St.
Harrisburg....Jackson and Raymond Aves.
Marion....315 S. Granite St., P. O. Box 747
Monmouth....509 S. First St.
Peoria....100–110 Edmund St.
Quincy....313 Delaware St.
Rockford....220 Prairie St.
Springfield....1000 E. Monroe St.
Streator....501 E. Hickory St.

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Fort Wayne....2206 Broadway
Indianapolis....330 W. New York St.
South Bend....412 East Tutt St.
Terre Haute....541 N. Fifth St.

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Des Moines....Third and Elm Sts.
Dubuque....Eighth and Washington Sts.
Fort Dodge....Central Ave. at Sixteenth St.
Ottumwa....207 S. Washington St.
Sioux City....410 Court St., P. O. Box 398
Waterloo....1209 E. Fourth St.

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Pittsburg....1201 North Broadway
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Allen....
Central City....306 Broad St.
Hazard....107 Main St.
Lexington....Third St. and Walton Ave.
Louisville....Jackson St. and River Rd.
Middlesboro....1701 Cumberland Ave.

LOUISIANA
Monroe....319 N. Ninth St.
New Orleans....118 N. Front St.
Shreveport....4107 Mansfield Rd.

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Portland....48 Commercial St.

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Baltimore....19 E. Lombard St.
Cumberland....18 N. George St., P. O. Box 172
Salisbury....Mill and High Sts.

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Cambridge....539 Concord Ave.
Indian Orchard....Paco Road
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Grand Rapids....435–459 Ionia Ave., S. W.
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Iron River....321 Carnegie Ave., P. O. Box 357
Ironwood....232 W. Ayer St.
Ishpeming....511 E. Vine St.
Jackson....518 S. Water St.
Lansing....617 E. Shiawassee St.
Muskegon....410–420 Morris Ave.
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Sault Ste. Marie....

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Minneapolis....334 N. First St.
Virginia....403 Chestnut St.

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Vicksburg....1701–03 Levee St., P. O. Box 322

MISSOURI
Kansas City....1427 West 9th St.
St. Joseph....920 S. Sixth St.
St. Louis....(See East St. Louis, Ill.)

MONTANA
Great Falls....420 Second St. S., (P. O. Box 1188)

NEBRASKA
Grand Island....311 West 4th St.
Omaha....1007–9–11 Jones St.

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Camden....Front and Division Sts.
Newark....251–55 Ridgewood Ave.

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Binghamton....100 Roundhouse Rd.
Brooklyn....1085 Grand St.
Buffalo....1345 Genesee St.
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Jamestown....610 W. 8th St.
Kingston....O'Neil St., Near Broadway
Niagara Falls....
Poughkeepsie....Smith St. and C. N. E. R. R.
Syracuse....376 W. Water St.
Utica....135 Hotel St.
Watertown....438 Court St.
Whitehall....35 Main St.

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Charlotte....205 W. First St., P. O. Box 777
Greensboro....Macon and Washington Sts.
Raleigh..McCullough & Lenoir Sts., P. O. Box 149
Wilmington....612 Surry St.
Wilson....700 S. Goldsboro St., P. O. Box 516

NORTH DAKOTA
Bismarck....209 Fifth St.
Fargo....414 N. P. Ave.

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Akron....97 East South St.
Athens....Corner Factory and Moore Sts.
Canton....618 Mulberry Road, S. E.
Cincinnati....67 Plum St.
Cleveland....1342 Hanna Bldg.
Columbus....330 Dublin Ave.
Dayton....104–114 S. Wayne Ave.
Gallipolis....700 First Ave.
Lima....338 E. High St.
Mansfield....131 E. Fifth St.
Massillon....405 W. Tremont St.
Steubenville....324–343 N. Seventh St.
Toledo....414 S. Erie St.
Youngstown....Jones and Brittain Sts.
Zanesville....Main and Second Sts.

OKLAHOMA
Enid....Chestnut and Adams Sts.
McAlester....31–37 East Chickasaw St.
Oklahoma City....112 E. Washington St.
West Tulsa....1402 W. 17th St.

OREGON
Portland....15th and Hoyt Sts.

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Allentown....311 Gordon St.
Beaver....486 Third St.
DuBois....Weber Ave. and Franklin St.
Erie....1502 Sassafras St.
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Hazleton....223 E. Mine St.
Johnstown....Messenger St. and B. & O. R. R.
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Philipsburg....North Front St., P. O. Box 146
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Pottsville....Railroad and Sanderson St.
Scranton....Penn Ave. and Vine St.
Shamokin....Fifth and Walnut Sts.
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Spangler....Bigler Ave.
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Williamsport....Canal and Court Sts.
York....204 N. George St.

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Greenville....15 E. McBee Ave.

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Sioux Falls....204 E. 10th St.
Watertown....224 First Ave., N. W.

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Beaumont....366 Liberty St.
Corpus Christi....1017–19 Tiger St.
Dallas....1118–28 Jackson St.
El Paso....317 N. Oregon St.
Fort Worth....13th St. and Jennings Ave.
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San Antonio....1302 N. Mesquite St.
Sweetwater....117 E. North First St.
Waco....617 Jackson St.
Wichita Falls....1507 Lamar St., P. O. Box 1713

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Salt Lake City....108 W. Second South St.

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Lynchburg....1324 Commerce St.
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Seattle....304 Railroad Ave., S.
Spokane....162 S. Post St.

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Charleston....Bullit St. and N. Y. C. R. R.
Clarksburg....608 North Third St.
Elkins....Railroad Ave. and First St.
Fairmont....Auburn St. and B. & O. R. R.
Huntington....207 Eleventh St.
Morgantown....610 University Ave.
Mount Hope....P. O. Box 416
Mullens....P. O. Box 37
Wheeling....Forty-third and McCulloch Sts.
Williamson....Foot W. Second St., P. O. Box 305

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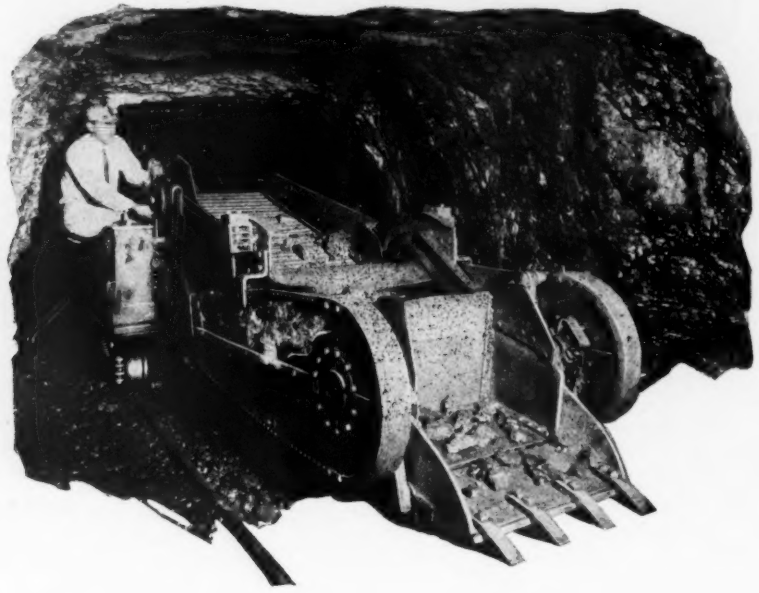
Appleton....909 N. Lawe St.
La Crosse....Front and King Sts.
Madison....513–19 Williamson St.
Marshfield....South Depot and Maple Sts.
Milwaukee....619 33d Ave.

WYOMING
Casper....218–34 Industrial Ave.

AN ENTRY DRIVER THAT
Meets the Demand for Development



"Machines Have Averaged as High as 72 Ft. of Entry a Day"

MECHANIZATION without rapid development is not practical, as to insure continuous operation in a concentrated area. New territory must be provided as fast as developed territory is worked out.

MYERS-WHALEY SHOVELS have met the demand for rapid development due to three prime factors—

First: **RELIABILITY**

that is freedom from delays due to breakdown of machines—one customer reports sixteen months operation of one shovel with but two hours' delay due to failure of machine.

Second: **SPEED**

Machines consistently load at an average rate of one ton per minute of actual operating time. 72 feet of entry as an average per shift is record performance but one machine drove 3411 yards of entry in one year with a total cost for upkeep of $137.96.

Third: **FLEXIBILITY**

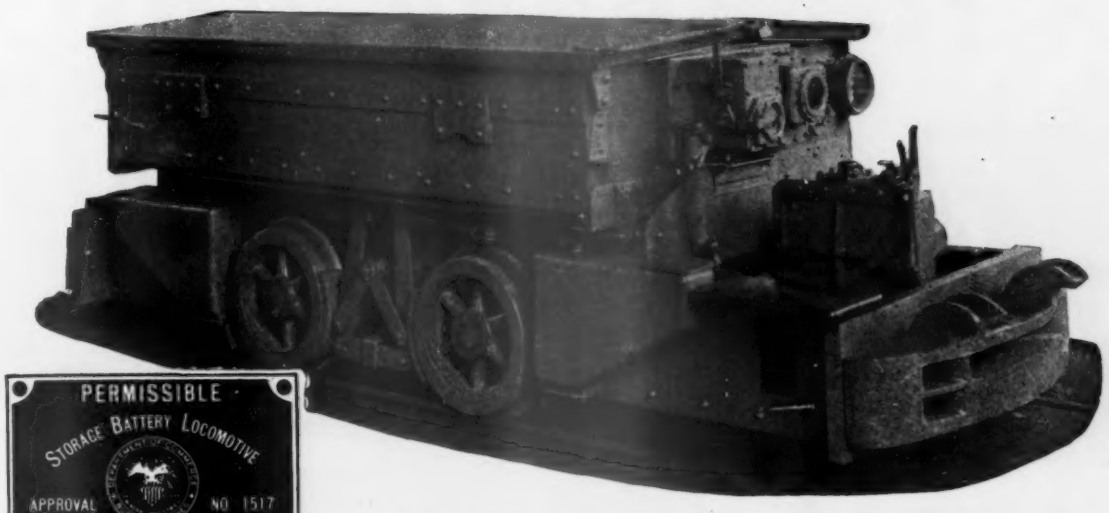
being track mounted and self-propelled, machine can be as readily moved from one working place to another as an arcwall cutting machine.

Write us for data on use of machines for tonnage loading of coal, entry driving, taking top or bottom rock in brushing, making grades, reopening aircourse, cleaning up old workings, etc.

MYERS-WHALEY COMPANY

KNOXVILLE, TENNESSEE

Myers The Pioneer of Mechanical Loaders *Whaley*



GUARANTEED

Guaranteed Safe—*having been tested and approved by the Bureau of Mines.*

Guaranteed Workmanship and Material—*covered by factory guarantee for one year.*

Guaranteed Performance—*covered by a written contract to produce definite results.*

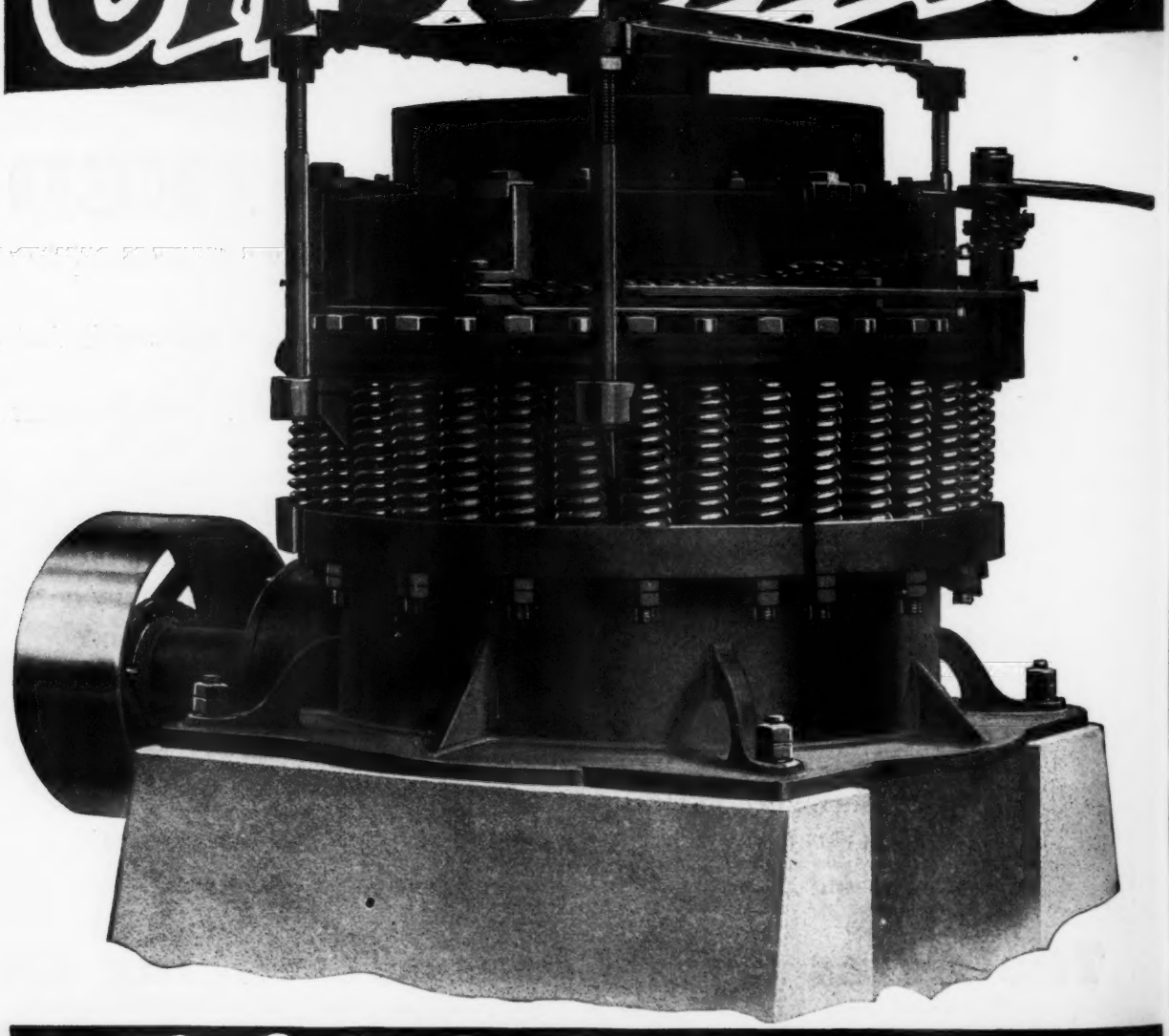
REMEMBER—When an Atlas man tells you that an Atlas Permissible Storage Battery Locomotive can do a certain job, and can work an entire shift in any mine on one battery charge, do not hesitate to give him an opportunity to demonstrate his claims. If he is right you get a cheaper haulage, fewer batteries, longer battery life and much lower maintenance costs. If he is wrong you are protected by the unqualified Performance Guarantee—ship the machine back and your money will be refunded. You take *no* chances, we take *all* the risk and consequently we can not afford to be wrong.

The Atlas Car & Manufacturing Co.

Engineers CLEVELAND, OHIO *Manufacturers*

Electric And Storage Battery Cars For Every Haulage Requirement.
Rotary Slate Cars—Scale and Transfer Cars
Battery Charging Stations

increase your CRUSHING



SYMONS

CAPACITY

without extra equipment

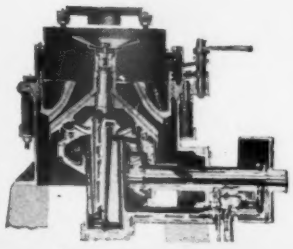
Before the days of the "Cone" this meant more than simply crusher change-over—it meant additional space—extra equipment such as screens, conveyors, power units, etc.

Illustrating the crushing action of the Cone

But—today—with the "Cone" *it actually means greater crushing output, crushed finer, with no more equipment and in many plants means cutting down the work required of auxiliary machinery.*

Just check these points—then write for descriptive catalog.

1.—a "Cone" requires no more space than an ordinary crusher—as a replacement it fits the same space. 2.—a "Cone" crushes to a uniform size—less circulating load—less oversize—less screening. 3.—a "Cone" requires less power. 4.—a "Cone" can be adjusted for different size products while crushing. 5.—in many cases one "Cone" is handling more material and crushing it finer than 2 to 3 previous crushers.



Sectional — showing Positive Oiling System

We'll be glad to tell you where Symons Cone Crushers are now making new capacity records.

SYMONS BROTHERS COMPANY

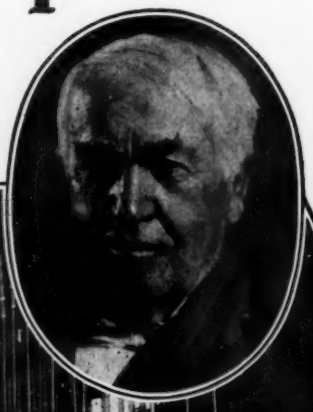
1462 STANLEY AVE, LOS ANGELES (HOLLYWOOD) CALIF.

111 W. WASHINGTON ST. CHICAGO, ILL.

51 EAST 42nd ST. NEW YORK, N. Y.

CONE CRUSHERS

16,000 Edison Lamps *at the mines of* Pittsburgh Coal Co.



M-S-A Equipment

At the mines of the Pittsburgh Coal Company, SAFETY comes first. Hence M-S-A EQUIPMENT.

The Pittsburgh Coal Company first installed ***Edison*** Electric Cap Lamps in 1914. To date they have purchased 21,000 ***Edison*** Lamps and are the largest users of ***Edison*** Lamps in the world.

Significant as this installation of ***Edison*** Lamps is, it is but one out of 1200 in the United States, Canada and Mexico—in fact, ten out of every eleven Electric Cap Lamps used are ***Edisons.***

Write for our "No Cash Outlay" plan of installation of ***Edison*** Electric Cap Lamps.

Lamp House
Warden Mine
Pittsburgh Coal Co.

Edison Model E
Electric Safety
Cap Lamp

Mine Safety MINE SAFETY APPLIANCES CO. PITTSBURGH, PA. *Appliances Co.*

Braddock Ave. & Thomas Blvd. Pittsburgh, Pa.

Keystone Grease Is the Working Mate of POWER!

The power for which in some form or other you pay, is pitted against two opposing conditions.

One is the force of Gravity—an honest adversary that gives and takes.

The other is Friction, a mechanical parasite, that exists only on the absorption of Power.

Keystone Grease will decrease friction and its kindred evils of excessive wear. In comparison with other lubricants, Keystone Grease costs slightly more per pound, **but vastly less per year.**

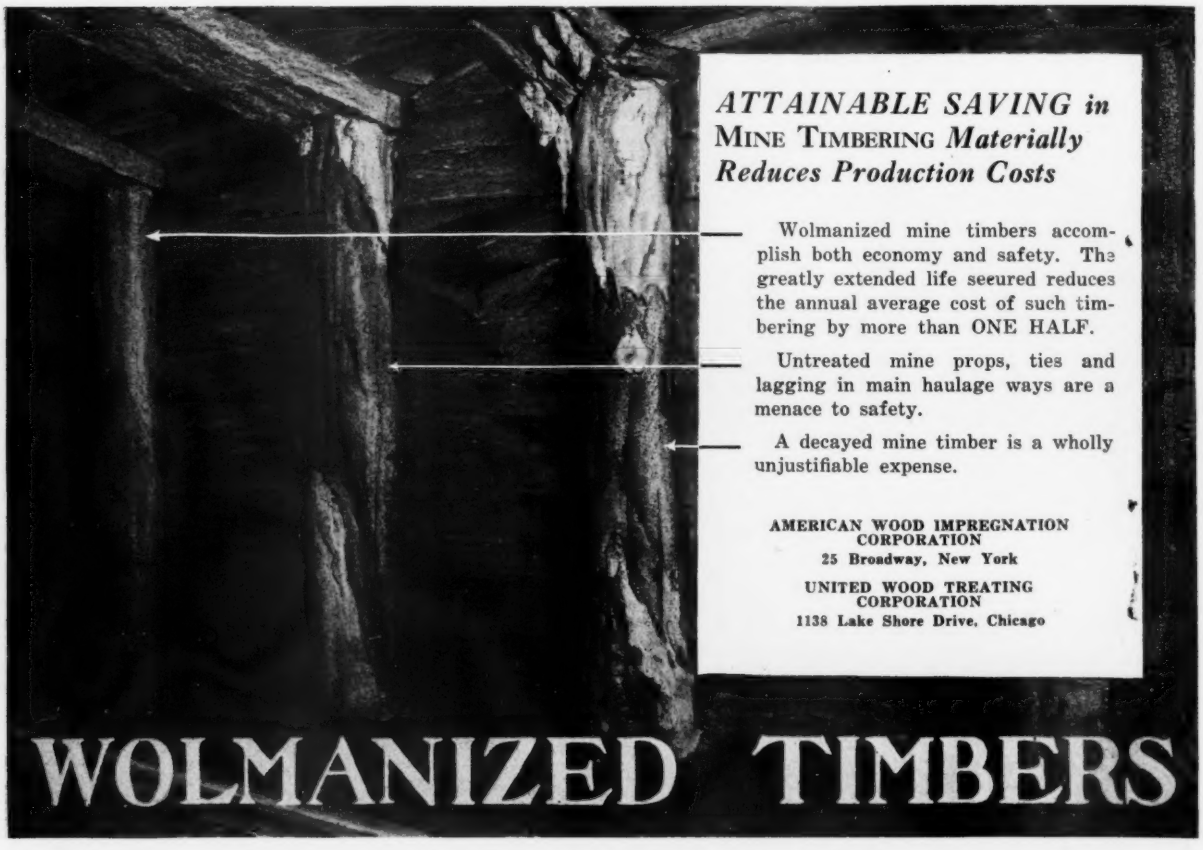
Write for literature giving facts that will save you money

KEYSTONE LUBRICATING CO.

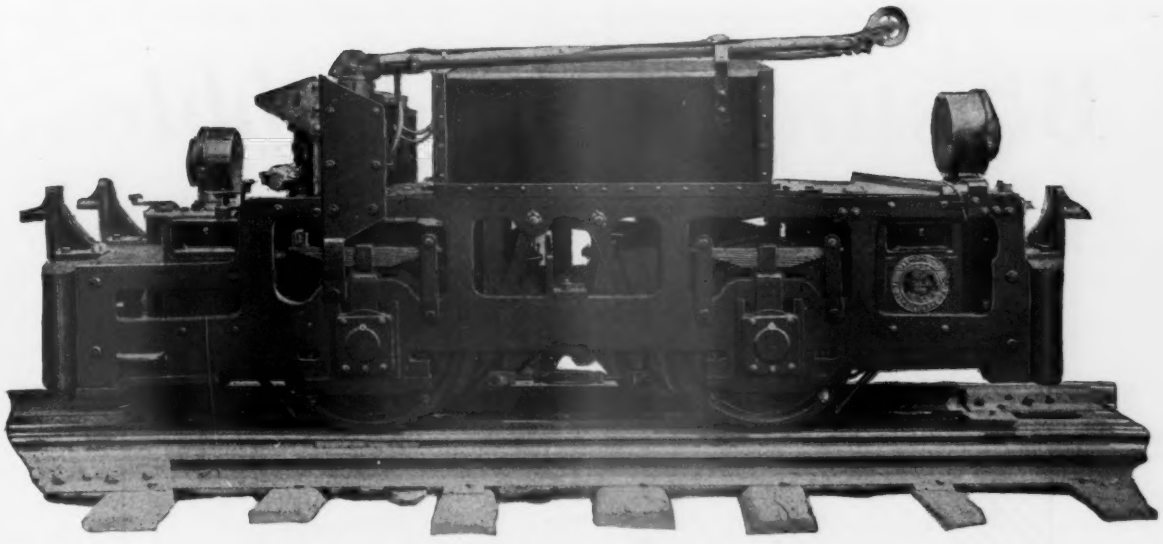
21st and Clearfield Streets *Philadelphia, Pa.*

Established 1884

KEYSTONE
TRADE MARK
Reg. U.S. Pat. Off.
GREASE


ATTAINABLE SAVING in
MINE TIMBERING *Materially*
Reduces Production Costs
Wolmanized mine timbers accomplish both economy and safety. The greatly extended life secured reduces the annual average cost of such timbering by more than ONE HALF.
Untreated mine props, ties and lagging in main haulage ways are a menace to safety.
A decayed mine timber is a wholly unjustifiable expense.
AMERICAN WOOD IMPREGNATION CORPORATION
25 Broadway, New York
UNITED WOOD TREATING CORPORATION
1138 Lake Shore Drive, Chicago
WOLMANIZED TIMBERS

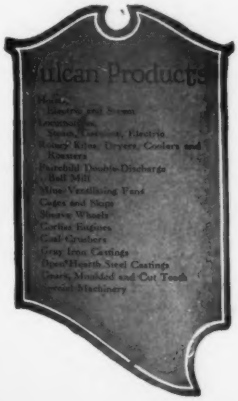
American Wire Rope
AND
AERIAL WIRE ROPE TRAMWAYS
Send for Illustrated Catalogue
American Steel & Wire Company
Chicago-New York



For beyond the trolley line and on the main haulage, too

Here's the Vulcan Combination Trolley and Battery Locomotive. It is built with the same equalization of pressure on the journal boxes as are the other Vulcan Electric Locomotives. Hence it rides smoothly over uneven tracks found near the face. Road shocks are absorbed by a type of spring suspension found only in the Vulcan design.

If smooth running interests you, plus low maintenance costs, unusual power and ease of operation—it will pay you to send for the complete facts about the Vulcan Combination Electric Locomotive and the other Vulcan Electric Locomotives—Trolley and Storage Battery types.

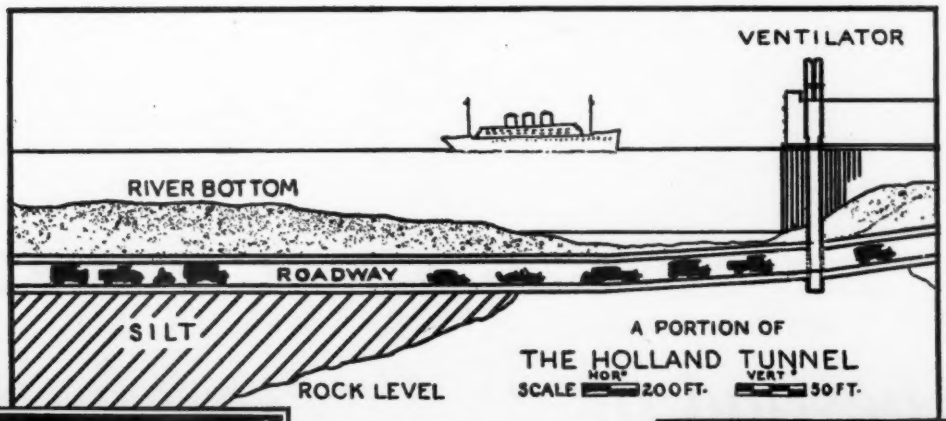


VULCAN IRON WORKS
WILKES-BARRE, PA.

New York Office: 50 Church St. | *Established* 1849 | **Chicago Office:** McCormick Bldg.

VULCAN IRON WORKS OF *Wilkes-Barre, Pa. U.S.A.*
STEAM GASOLINE ELECTRIC **LOCOMOTIVES**

Blasting in a Bubble..



THE above profile indicates the rock which had to be blasted out to make way for the tunnel. 12,177 cubic yards of rock were blasted in the tunnel and 5,056 cubic yards in the shaft to the ventilating building on the New York side.

(*Left*) North Tunnel: New York and New Jersey shields the day prior to their junction. Booth & Flinn, Ltd., contractors.

(*Right*) Meeting of the upper cutting edges of the New York and New Jersey shields in the North Tunnel. They met under the Hudson River at about Sta. 64/-50. Booth & Flinn, Ltd., contractors.

All work on the tunnel was under the direction of the New York and New Jersey Bridge and Tunnel Commission.

DU PONT

Reg. U. S. Pat. Off.

.....to build the..
HOLLAND TUNNEL

Between New York and New Jersey
Under the Hudson River

Men who gamble with life . . . locked in a huge bubble of compressed air . . . 107 feet below the city streets . . . beneath the bottom of the mighty Hudson . . . their lives held in the very balance . . . the balance between compressed air pressure and hydrostatic pressure of tons and tons of water . . . no escape . . . shut off from mankind and the world above by the great steel cutting shield . . . all about them a formless world of water, silt and rock . . . up to their knees in muck and slush . . . *SUDDENLY A DENSE FOG HIDES THEM FROM EACH OTHER* . . . the fearsome noise of rushing water . . . they wait still and tense . . . to be buried alive . . . or to carry on . . . the shield stops moving . . . the fog clears . . . rock struck . . . the tunnel must not deviate from its course a fraction of an inch . . . rock drillers enter the bubble . . . the obstruction is loaded with dynamite . . . men

[*George H. Flinn, Chairman of Booth & Flinn, Ltd., firing final blast for holing through North Tunnel.*]

retreat back of the shield . . . a dull "boom" and the giant jacks push the shield ahead.

Daily in those four long years every man from the chief engineer down to the lowest sand-hog grinned at Death. There was no other way to build the greatest twin vehicular tubes in the world. 9,250 feet long, a two-mile subaqueous street thirteen feet six inches high and twenty feet wide.

Twelve thousand, one hundred and seventy-seven cubic yards of rock were blasted in the tunnel under these conditions and five thousand and fifty-six cubic yards of rock blasted in the New York ventilation shaft down *to* the tunnel. 73,950 pounds of 60% du Pont Special Gelatin and 69,200 du Pont Electric Blasting Caps were used in blasting these 17,233 cubic yards of rock. Despite the extremely dangerous conditions under which this blasting was done, not a man was injured. The explosives were delivered every morning and the unused explosives removed at night by du Pont delivery boats.

Where life and the success of so great an undertaking were at stake, naturally the engineers in charge of this work selected du Pont explosives and accessories. There is a vital significance in the association of du Pont explosives with great construction and industrial enterprises of the Nation.

E. I. DU PONT DE NEMOURS & CO., INC.
Explosives Department
WILMINGTON - DELAWARE

DU PONT

Reg. U. S. Pat. Off

Enterprise Trucks and Mine Cars Provide the Lowest Cost Per Ton Coal Transportation

MANY users testify that Enterprise Mine Cars provide the lowest cost per ton for coal transportation. Here is one concrete illustration.

The Elkhorn Coal Company of Kona, Letcher County, Kentucky, purchased their first Enterprise Trucks in 1920 and they are still in service. Since that time they have purchased 410 sets of Enterprise Trucks. On April 1, 1927, their total repair bills had amounted to $11.95. This unsurpassed economy is due to scientific modern design. Extremely low operation and maintenance records are nothing new with Enterprise Mine Cars. Every Enterprise Mine Car and Truck is designed and built to save you money. Here are five outstanding reasons why Enterprise Trucks and Mine Cars will reduce your per ton transportation cost.

- Less cost for repairs.
- Less power used in starting loads
- Less friction in operation
- Less grease for lubrication
- Less cars required on account of greater carrying capacity

A combination of economy features we do not believe can be found in any other mine car or truck. We have cataloged the experiences of a number of users and have backed up our every statement with scientific proof in a very interesting booklet that is absolutely unlike any other machinery catalog. It is a mine of information to every coal operator and if it cost five dollars you would certainly own one. It is just as valuable, however, if it does cost you only the price of a postage stamp. The edition is limited, write for a copy today.

ENTERPRISE
WHEEL AND CAR CORPORATION

Bristol, Va.-Tenn. Huntington, W. Va.

The MINING CONGRESS JOURNAL

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VOLUME 13 NOVEMBER, 1927 NUMBER 11

THE CONVENTION

THERE IS NO MORE EFFECTIVE MEDIUM for the exchange of ideas than through the Convention Plan. Intelligent exchange of ideas spells progress. Industry meets, exchanges ideas, experiences and opinions in annual convention and adds materially to the knowledge of those in attendance, who return to their respective communities with broadened vision, more tolerance, and a keener appreciation of the magnitude of the industry with which they are identified.

The 30th Annual Convention of The American Mining Congress opens the door of opportunity wide. It will discuss problems of major importance, including the Economic Importance of Mining, Modification of Anti-Trust Laws, Centralized Government, and Legislative Proposals. The speakers are of national repute.

If it is true that there is no limit to the value of a good idea, what estimate can be placed upon a convention to which will come the rank and file of the mining industry—an industry that stands preeminent in this our mineral age—an industry that is indispensable to human progress! Surely much good will accrue through this "intelligent exchange of ideas."

COMMISSION SETTLEMENTS

FOUR YEARS AGO the United States Government spent some $600,000 of the people's money to discover what was wrong with the coal industry. That famous Commission was considered the ultimate in the commission idea in coaldom, but no one was ever able to point to anything constructive that resulted from its work. In spite of that gigantic failure, Illinois coal operators have turned again to the commission idea to settle their troubles.

It is true that the Government's Coal Commission was purely an investigative commission, without power to enforce its recommendations. The Illinois Commission's findings will be binding upon the disagreeing factions. For this reason, as little as we like commission form of dictatorship, this newly organized commission has an opportunity to render the coal industry a real service, through advocating the abolishment of the certificate law, the adoption of mechanization, and resumption on a scale that is equitable.

It is greatly to be hoped that the Commission will in its studies find a real remedy for the repeated cessation of mining activities in Illinois, and that its recommendations may be so sound that that much harassed industry may proceed without further impediment, and that Illinois will once again be able to compete in her own markets.

MINE DEPLETION

DEPLETION ALLOWANCES of the mining industry have been the subject of an intensive study by the Joint Congressional Committee on Internal Revenue Taxation. For several months the committee has had a staff of mining engineers compiling depletion data in cooperation with engineers of the Bureau of Internal Revenue. In order to expedite the work and insure satisfactory results, the Commissioner of Internal Revenue asked the industry to supply certain information that would have been very difficult to assemble from the records of the bureau, and impossible to compile in the short time available. The mining industry responded promptly and fully to the Commissioner's questionnaires, and the cooperation and assistance thus afforded by the industry has enabled the Commissioner to assemble figures for the Joint Committee that otherwise would have required many months of effort and a large staff to gather the data from the bureau records.

The purpose of the study was to inform Congress as to the operation and effect of the depletion provision. The mining industry, generally speaking, has been reconciled to the present provisions of the law which allow depletion deductions on the three bases of (1) cost, (2) March 1, 1913, value, and (3) discovery value in the case of mines discovered after February 28, 1913. But there have been numerous cases in the industry where the depletion allowances on cost or March 1, 1913, value has been inadequate. In many of these cases geological conditions and other factors have made it impossible for the taxpayer to secure a proper allowance for discovery value on mineral reserves discovered and developed subsequent to February 28, 1913, which were not included in "probable" or "prospective" reserves in any prior valuation for depletion purposes. The effect of such discoveries and developments has been, under the income tax unit rulings, to dilute the unit of depletion previously allowed, and in some instances to prevent any depletion. The result has been grossly unfair and inequitable as to taxpayers having such cases.

Those thus discriminated against include many small mining enterprises widely scattered through all the mining states. These smaller enterprises are entitled to the consideration of Congress and the support of the mining industry as a whole in an effort to obtain justice. The report of the Joint Committee should take cognizance of their situation, and should supply the information necessary to enable the Ways and Means Committee to recommend a proper measure for the purpose of giving them justice.

The American Mining Congress, from the beginning of its efforts to secure recognition of the fact of depletion of mines in the 1913 law, has contended that a mining enterprise is entitled to the full value of mineral reserves in place as a deduction in the determination of taxable income derived from the production of such

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mineral. That is, the mine taxpayer should be allowed to deduct from the sale price of every unit produced, the value of such unit in the ground, this deduction being a return of the taxpayer's capital.

Justice Brandeis in the case of Ludey *vs.* U. S., decided May 16, 1927, says that "the deduction is to be regarded as a return of capital, not as a special bonus for enterprise or willingness to assume risks." He likened the depletion deduction of mines to the using up of raw material in making the product of a manufacturing establishment, and concluded that "as the cost of the raw material must be deducted from the gross income before the net income can be determined so the estimated cost of the part of the reserve used up is allowed."

The principle that mineral reserves in place are the mine taxpayer's capital, on each unit of which he should be allowed to deduct from the sale price the value of such unit in place before payment of any income tax, has been fairly well recognized by Congress in the existing income tax law. Therefore, the fact that a portion of the mining industry is not able to secure a reasonable allowance, or as is the case in some instances, any allowance whatever, should be brought to the attention of Congress where an effort should be made to secure a full measure of justice.

As the result of the Joint Committee's study, it is believed that there will be no further attacks on the existing provisions of the income tax law. Cases where the amount of the allowance might be criticized are the exception and not the rule, and the Joint Committee undoubtedly will find ample support for a report to this effect. So that the problem now is simply one of amending the depletion section in such a manner as to make it fairly applicable to that portion of the mining industry that has been unable to come within existing provisions of the law with the rest of the industry, and to simplify the administration of the law for the industry as a whole and the Government.

In whatever action Congress may take, however, it should be clearly understood that no part of the industry should be subjected to increased taxation through any reduction of allowances already made by the Government, as this would be as grossly discriminatory as a straight increase in the tax rate on a portion of the industry especially singled out for such an increase. Any such action would be opposed by the full strength of the industry.

MINING AND NATIONAL PROSPERITY

ADMITTEDLY THE UNITED STATES is the most prosperous nation on earth today. This is due to many factors, including American enterprise, but largely due to our great natural resources. We are living in a mineral age, few people realizing the great part minerals play in their every-day comfort and happiness. Minerals form the basis of a considerable portion of our industrial life, as is proved conclusively by the fact that more than half the freight carried by our vast railroad systems comes directly from our mines.

A prosperous mining industry means a prosperous nation. In 1926 producers of minerals maintained an extraordinary high level, even surpassing 1925, which was a year of outstanding prosperity and high record output. Measured by the total value of mineral products—$6,262,000,000—the output of 1926 was the next largest ever recorded. As compared with the values of the total mineral output for 1923, 1924, 1925, in which years the average price levels of all commodities were not materially different from that of 1926, increases of 5 percent, 18 percent,, and 10 percent, respectively, are indicated.

Bituminous coal production for 1926 closely approximated the war record; anthracite production was maintained at a good rate; a record output of crude petroleum was attained; zinc production was notably increased; gold and silver production continued its downward course, gold having steadily declined in production since 1916, and silver production decreased steadily, due to the reduction in price of silver of seven cents an ounce less than in 1925; copper production increased moderately, imports were larger and exports smaller, with a marked increase in domestic demand; the lead and zinc industry in 1926 was marked by record production, intense activity and high prosperity, although price levels were slightly lower than in 1925; iron and steel recorded a remarkable year, the output of iron ore was notably larger, while production of steel was the largest ever recorded; the non-metallic industries showed a slight decline as compared with 1925, but nevertheless remained at a high level in relation to preceding years.

The first ten months of 1927 probably will not show such satisfactory results, although there should be no startling falling off in production of any of the minerals.

The mines of the Nation need encourageemnt, for they are one of our greatest, if not our greatest, national asset.

WHO OWNS THE RAILROADS

THE COMMITTEE ON PUBLIC RELATIONS of the Eastern Railroads, recently published some interesting facts concerning railroad ownership. According to their statement, based on figures compiled from the official reports of the Interstate Commerce Commission, on December 31, 1925, there were 868,601 holders (not including approximately 50,000 railroad employes buying stock on installment) of the capital stock of all steam railways in the United States, the par value of such stock being $9,621,780,069. On a basis of $100 par value the average holdings of each owner was slightly more than 100 shares. These figures take no account of the million or more railroad bondholders, scattered all over the United States, whose interest in the financial success of the railroad is equally as great as that of the stockholders. Holders and beneficiaries of more than 17,000,000 life insurance policies, 54,000,000 industrial insurance policies, and 46,000,000 savings bank depositors are directly interested in the successful operation of the railroads, because insurance companies and savings banks are particularly large owners of railroad securities.

These are only a few of those who "own the railroads," but it can be plainly seen that whatever affects them is felt by people in every walk of life.

Any socialistic party bent upon Federal ownership of our railways, popularly termed "public ownership," would have great difficulty in proving that the public does not already own the railroads.

The same may be said of practically all great enterprises. Analysis will show that the "peepul" control a vast amount of industry through "ownership" that is more effectual than any kind of political control.

BIG BUSINESS

ON EVERY HAND there is the booming of political guns, as with great eclat some favorite son throws his hat into the ring. The atmosphere is already resounding with political speeches, and the tempo will steadily increase with the incoming session of Congress.

Some of these candidates have adopted as a campaign weapon a war-cry against big business. Combinations in industry are not what President Roosevelt made famous through his "trust-busting" campaign. We have progressed amazingly in the past twenty years, and have reached the point where the public is beginning to understand through actual experience that combinations in ownership and operation reduce costs and improve service, and that any combination that is so unintelligent as to fail to protect the interests of its consumers, is only adopting one form of suicide.

Who is there today who sincerely believes that the United States Steel Corporation is a menace? Who is there today who believes that Henry Ford is a "monopoly" and therefore should be repressed for the good of the people? Or that any other of the large units of industry that have combined to give American people the greatest luxury at the least cost of any country in the world are unwise? What has been back of our great advancement if it has not been mass production, and how may mass production be accomplished except through combinations?

Congress spent many years in investigating the steel industry, looking diligently for the inimical thing that was said to exist; the Standard Oil has been investigated, as have other large combinations of capital, with the result of proving again and again that large aggregations of capital, coupled with the use of common sense, insure wise handling of affairs.

Today Mr. American Citizen is enjoying luxuries he never could have had but for large aggregations of capital; he has a car, his wife has the latest electric servants in her home; his work is simplified by machinery—and all of this made possible by mass production. Large combinations of capital have made the United States the richest country in the world. They have discovered the possibilities of high wages through mass production. They have raised the standard of living to hitherto unknown heights for the average citizen. Certainly considering their economies, their efficiency, their service, commendation should be their lot rather than condemnation.

PETROLEUM WASTE

THAT OVERPRODUCTION OF OIL is negligible in comparison with the total amount of oil produced and consumed is the opinion of some of the leading oil producers. It has been pointed out that if the amount of the overproduction could be kept in the ground and saved for future generations, a very simple mathematical calculation would show that it would be an altogether negligible amount at the end of a generation as compared with the probable demands of the country at that time. A leading oil operator recently made the following statement:

"There is no physical waste of petroleum produced under present methods. The alleged waste arising through excessive flow of gas in production of oil is theoretical. It is not measurable and is certainly not uniform as between different pools, or different wells in the same pool. No uniform oil-gas ratio could be adopted which would work in practice. There is no physical waste in the production of oil which can at present be corrected by legislation."

Experience and application of various theories in actual production will throw additional light on the function of gas in the production of oil, and possibly at some time in the distant future it may be possible to intelligently make some practical application, but certainly the present state of knowledge in the industry is not such as to make a uniform rule applicable.

If conservation that really means anything in the way of production of a future supply of petroleum for national defense or any other national use, is discussed, it must involve limitation upon consumption, and the restriction of petroleum to so-called oil uses—in other words, a prohibition of the use of petroleum in competition with coal.

Government interference in the oil industry is unthinkable, would create chaos, and destroy the oil industry and the investments of hundreds of thousands of citizens. Any arbitrary control or enforced cooperation which involves the exercise of human judgment, or the relegation of autocratic power to commissions or individuals is bound to fail. If there must be control, it should be upon some fundamental and logical principle, such as the prevention of actual waste by prohibiting the escape of any gas whatever into the atmosphere. While any such law would be revolutionary and certainly not constructive, it would at least be based upon a solid principle.

Careful study would indicate that the knowledge regarding the industry is such that at the present time no legislation would be justified, unless it be modification of the Anti-trust law, which would permit of cooperation among producers in a united effort to effect stability in the oil industry.

DOCTRINE OF STATISTICS

THE DOCTRINE OF STATISTICS as advocated at the recent meeting of the American Federation of Labor, if followed strictly, would end the strike menace in industry. President Green strongly recommends the substitution of statistics for strikes in the settlement of labor disputes.

The adoption of such a policy by the labor leaders would herald a new day for labor, and would indicate a progressiveness that has been lacking during the recent years—years in which the labor movement has lost thousands of supporters.

In advocating this policy, the Federation gives warning that the "unions must gather their own statistics and make their own interpretation of the statistics compiled by the bureaus and employers." We have no fault to find with this declaration. The more deeply they go into such investigations, the sooner they will be convinced that high wages are possible only through maximum per man production attained through use of machinery and strict executive supervision, and that wage adjustments which are satisfactory alike to those who pay them and those who receive them, are inalterably complicated with the problems of production.

While they still cling to many fallacies, such as shorter hours and higher wages, including a campaign for the five-day week, and insist that wages must be satisfactorily determined before there can be cooperation

in the problems of production, the convention at Los Angeles indicates that labor is awake to the obsoleteness of the strike method, which has gained little for them, and is ready to adopt the more progressive method of facts and cooperation.

THE ILLINOIS TRUCE

THE COAL OPERATORS OF ILLINOIS and the United Mine Workers have recently reached a decision to resume operations under the Jacksonville Scale pending further negotiations which will be carried on between now and April 1, 1928. We use the word "decision" advisedly; certainly it is not a "settlement" and the word "agreement" in the sense of a concerted and harmonious concurrence by all parties concerned can hardly apply in this particular case. As a matter of fact it seems to be a truce and nothing more.

There will be many within the mining industry who will criticize the operators for their decision to resume work at the Jacksonville Scale even under the temporary terms that have been made and will interpret this as a complete surrender to the demands of the United Mine Workers. The miners who have heard the repeated statements by the operators that resumption of work on the Jacksonville Scale meant bankruptcy to the mines, may now be somewhat inclined to regard this statement as mere propaganda. We believe that the truth may be in neither of these views.

The operators of Illinois and Indiana have said that their mines can not pay the Jacksonville Wage Scale and operate at full time. They have advocated and urged the United Mine Workers to accept a reduction from this scale in order to compete with the production from the non-union fields and to secure a greater volume of business than is now possible under the higher prices which they must charge when paying the present scale. This, they have contended, would result in a more regular operation for their district and allow them to operate their mines on a full time basis; if otherwise, they and their employes could not expect to do more than supply the demand which the non-union fields were unable to furnish.

In deciding to reopen their mines and resume work on the Jacksonville Scale the operators have not receded from their previous position or retracted any of their statements. They still insist, and events will undoubtedly prove them right, that the acceptance of the Jacksonville Scale will not result in full time operation for their mines or full time employment for their workers. The six-month period of idleness which has just passed proves this contention and after the present seasonal market demands have been filled the miners can expect another period of idleness to follow.

Whether the action of the operators in agreeing to the present truce was wise or not will be determined by the result of their negotiations with the United Mine Workers between now and the first of April. If they succeed in establishing a fair and equitable wage rate that will enable them to compete with other mining fields then it may safely be said that their present course was the best for them to pursue. If, on the other hand, the United Mine Workers adhere to their past policies and stubbornly refuse to recognize and adjust themselves to existing economic conditions then no good will result from the present truce and both parties are merely putting off the day when the adjustment must be made and economic facts must be faced.

INCREASING INTEREST IN SAFETY

THERE HAS BEEN a steadily increasing volume of criticism directed at the mining industry, from within and without, concerning its accident record. This criticism has been particularly vicious from within the industry and, we have felt, not wholly justified. With some 25 agencies hounding the industry with s a f e t y propaganda, it scarcely seemed reasonable that some of it had not taken root and that more along safety lines was being done than was given credit for.

Shortly after the May meeting at Cincinnati, where an unsuccessful attempt was made to publicly discuss safety, the American Mining Congress mailed a questionnaire to each coal and metal operating mine on the lists of the State Mine Inspectors. For five months the replies to the questionnaire have been coming in, until a large percentage have been heard from. Of this percentage of replies, at least half of the companies have some definite form of safety organization; others have trained first-aid crews and first-aid stations; others maintain only first-aid stations. Practically all of the larger producers have adopted some form of mine safety organization, and many of them have a full-time safety official. Others have part-time safety men, while still others include safety work as a part of the regular duties of their superintendent.

The foregoing should prove that safety is not as neglected a factor in mineral production as its critics would indicate. There is vast room for improvement, but the safety-first idea is just beginning to pay dividends, and with the spread of the safety organization idea at individual properties, the results will be continuously better.

To show what the industry is doing, we have scheduled a series of articles on safety organizations at both coal and metal properties during 1928, the first two articles appearing in the January number. The safety idea needs encouragement. It has not failed. Real information concerning its growth has been lost in the mass of criticism of the industry *en masse*. As the mine operator learns the results being attained, he will be more inclined, forced if you will, into thinking, doing and being "safe."

Safety in any line of work is controlled almost entirely by the human equation. The worker himself must be reached with a plausible reason for prescribed precaution, and if he will not adhere to the rules, such remedies should be applied as will force him to think and obey. Such compulsion has taken the form of lay-off, fines and public posting. With the right kind of safety organization, such drastic action is not necessary. Cooperation has taken the place of compulsion. It has been proven that when interest is aroused, half the problem is solved.

The same principle is true as applied to those responsible for safety work. When his neighbor is achieving splendid results through proper safety precaution, the operator is forced to acceptance whether he believes in it or not.

Compulsory state and national regulation will not in any sense lessen the accident toll. It is a problem for the individual mine, and we firmly believe that the individual mine is taking an intelligent interest in it and is solving the problem. Another year's record should tell exactly how deeply the safety-first movement has taken root in its revival.

30TH ANNUAL CONVENTION OF THE AMERICAN MINING CONGRESS

Board Of Directors Announce Dates For Thirtieth Annual Meeting—Program Of Unusual Interest Planned—Special Entertainment Features Arranged—Speakers Of National Import

THE Board of Directors of The American Mining Congress have announced the dates of December 1, 2, 3, for the thirtieth annual convention of the organization, which will be held at the Hotel Mayflower, Washington, District of Columbia.

A program of wide and varied interest has been arranged, which includes the general topics of Economic Importance of Mining; States Rights, Individual Initiative and Centralized Government; Modification of the Anti-Trust Law; Legislation, and Progress in the Industry.

The speakers are of national importance, including Hon. Herbert Hoover, Secretary of Commerce; Hon. Scott Turner, Director U. S. Bureau of Mines; Senator Tasker Oddie, Chairman, Mines and Mining Committee of the Senate; Governor George H. Dern, of Utah; William Loeb, vice president, American Smelting & Refining Company; Sidney J. Jennings, president, United States Smelting, Refining & Mining Co.; William H. Lindsey, president, The American Mining Congress; J. G. Bradley, president, Elk River Coal & Lumber Co.; A. Cressy Morrison, Union Carbide Company; Harry N. Taylor, president, U. S. Distributing Corp.; Robert N. Miller, tax consultant; Charles D. Hamel, counsel Joint Committee on Internal Revenue Taxation; Paul Armitage, attorney; Dean Holbrook, School of Mines, University of Pittsburgh; H. W. Seaman, Trojan Mining Co., and others to be announced later.

Interesting features of the program will be the "Bureau of Mines Hour," to be conducted by Hon. Scott Turner, Director, Bureau of Mines, and the "Bureau of Internal Revenue Hour," conducted by Commissioner Blair, of that bureau.

Director Turner will have the heads of each of the divisions of the bureau tell

something of their work for the industry. This should be a distinctly valuable "hour" in so far as the industry is concerned, and should contribute greatly to a better understanding between the industry and the bureau that represents it in the government.

Of equal importance is the "Revenue Hour," which will be used by engineers and accountants of the Bureau of Internal Revenue for discussion of general and practical administrative problems involved in valueing mines and auditing returns of mining taxpayers.

Bulkeley Wells

Louis S. Cates

The discussion of the "Value of Investigations," which has been arranged for the second session of the convention, should help to clear the atmosphere created by the investigative proclivities

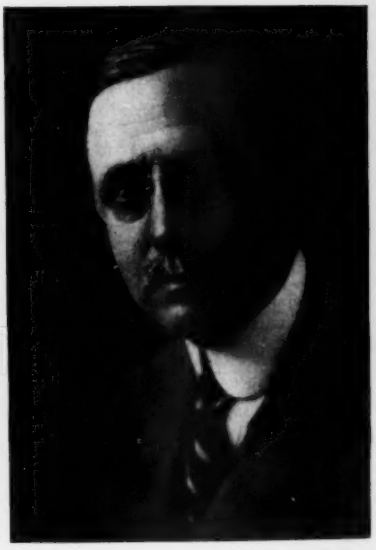
Wm. H. Lindsey, President of The American Mining Congress

which have marked recent sessions of Congress. There is every indication that this tendency will reach a high point at the coming session. A recent statement by a prominent mining man that "such investigations work great hardship on industry, and accomplish little good, defeating the purpose for which they are inaugurated," seems to reflect the general attitude on this subject, and considerable importance may be attached to the discussion scheduled.

Modification of the Sherman law will be discussed at one entire session of the convention. Harry N. Taylor, president, The United States Distributing Corporation, will preside, and the addresses scheduled are of more than ordinary import. There is a steadily growing belief among the producers of natural resources that some change must be made in the anti-trust laws, which will permit self-control of industry. This sentiment has gone so far as to bring forth a suggestion from Secretary of the Interior Work that the law be modified in the case of the oil industry. Many coal operators believe that some modification of this law is essential to the satisfactory solution of that industry's problems, and the zinc industry is of a like opinion.

Sidney J. Jennings

H. W. Seaman

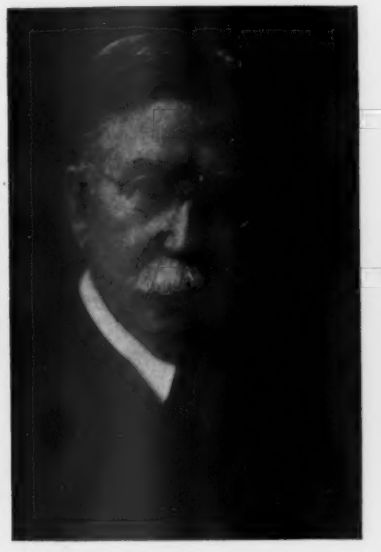


Archibald Douglas

J. G. Bradley

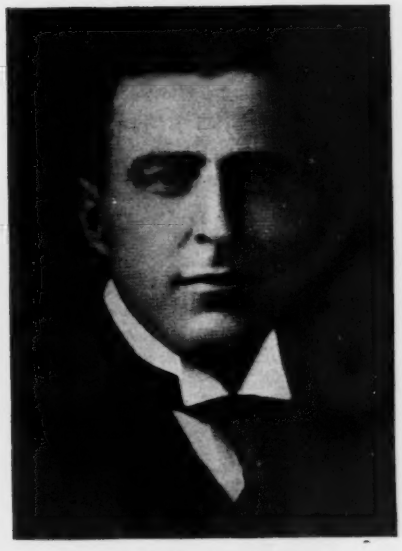
Robert E. Tally

Hugh Shirkie



E. L. Doheny

George B. Harrington



Stanly A. Easton

J. T. Skelly

This discussion is therefore extremely timely, and should contribute much to a better understanding of the application of the law to the industries involved.

According to the announcement of the board, William H. Lindsey, president of The American Mining Congress, will open the convention with an address that will "sound the keynote of the convention and advance a program of performance as visualized by The American Mining Congress."

"Legislating for Natural Resources" will be discussed at the second session of the convention, when Senator Tasker L. Oddie, chairman, Mines and Mining Committee of the Senate, will outline what is on the legislative calendar for mining.

"States Rights, Individual Initiative and Centralized Government," occupies the attention of one session. An interesting presentation at this session will be an address by A. Cressy Morrison, of the Union Carbide Corporation, on "International Centralization as Suggested by the Geneva Conference." Mr. Morrison attended the Geneva conference, and will bring an interesting analysis of their suggestions before the mining industry.

Other sessions will devote their attention to Mine Taxation, and Progress in

the Industry. A get-together luncheon has been arranged for delegates on December 1, at which five-minute talks will be made by prominent mining men on the "State of the Industry." Speakers include:

Julian D. Conover, secretary-treasurer Tri-State Zinc and Lead Ore Producers Association, Miami, Okla.; Rice Miller, president, Illinois Coal Operators Association, Hillsboro, Ill.; P. H. Penna, secretary, Indiana Bituminous Coal Operators Association, Terre Haute, Ind.; Stephen Tuthill, secretary, American Zinc Institute, New York City; E. W. Parker, director, Anthracite Bureau of Information, Philadelphia, Pa.; Dr. E. H. Wells, New Mexico School of Mines, Socorro, N. Mex.; Jesse F. McDonald, president Metal Mining Fund, Colorado Mining Association, Denver, Colo.; A. G. Mackenzie, secretary Utah Chapter of American Mining Congress, Salt Lake City; Henry M. Rives, Nevada Mine Operators Association, Reno, Nev.

Hotel Mayflower, Convention Headquarters

Among the important addresses are: Mining, the Keystone of Industry; Economic Importance of Mining to the Nation; A Plea for Unity in Natural Resource Industries; What Is on the Legislative Calendar for Mining; Federal Control—the Bugaboo of Industry; Legislative Investigations and Prosperity; Growing Tendency Toward Centralization of Government; International Centralization as Suggested by Geneva Conference; The Ever-Present Public Lands Question; Stimulating Southern Mineral Development; Meeting Competition by a Sound Method; Will Modification of Sherman Law Solve Coal's Largest Problem; The Sherman Law Applied to a Natural Resource—Oil; Lawful Combinations in Industry; Organization and Procedure of Bureau of Internal Revenue; How Proposed Simplification of the Federal Income Tax System Should Benefit Taxpayers; Proposed Revenue Legislation to Be Considered by the Seventieth Congress; Progress in Studies Being Made by Joint Congressional Committee; Comparative Study of Mining and Other Industrial Enterprises from Tax Standpoint; Better Financing Methods for Mining; What Year's Study Has Developed in Solving Silver Producers' Problem; The Hydraulic Miner; Shall Industry Create Its Own Standards; Oil Shale.

The special entertainment features include privileges for golf at some of Washington's finest clubs, including Congressional and Columbia. The Board of Directors will entertain delegates at an informal reception and dance at the Mayflower, and the annual banquet will be followed by dancing. Special entertainment is being arranged for the ladies, including theater parties, teas, and sight-seeing.

Altogether the thirtieth convention offers a wonderful opportunity to combine business and pleasure. Washington is delightful at this time of the year, offering much in the way of unusual entertainment. These conventions held at Washington have proved to be delightful, extremely helpful, and of great benefit to the mining industry.

"—about one-third of our state taxes go into highway building"—

GOVERNMENT OWNERSHIP *of* INDUSTRY*

Seventy-Two Percent Of Replies To Nation-Wide Questionnaire Absolutely Oppose Tax Exempt Securities And Favor Legislation Prohibiting Their Issuance—Government In Business Strenuously Opposed—Education On Basic Principles Of Economics Urged

IN response to the questionnaire submitted in November, 1926, to 500 men and women in various professions, trades and production groups, the inquiry about Government ownership elicited the largest number of replies.

The original question was as follows:

"During the past two years there has been much discussion of the invasion of government into private industry. This is exemplified by a wide range of illustrations. Its ramifications lead from municipally-operated street railway and lighting systems, into state-operated insurance, and construction of public works by day labor instead of contract, construction service by navy yards for outside parties, and the manufacture of clothing, paints and many other articles in competition with private enterprise.

"Taxes must be levied and collected or there will be no government. If all utilities were publicly owned, the cost of government would be no less, while taxes necessary to defray the expenses of government would have to be raised through other sources.

"State and local indebtedness represented by tax-exempt securities is increasing over one billion dollars annually. While Federal taxes are being reduced, state and local taxes are being increased. The enormous annual increase of interest and sinking fund charges is not and can not be offset by economies in other items of public expenditure.

"What measure or measures would you suggest to slow up the issuance of tax-free securities, and how may the increase in state and local taxes be curbed? What action should be taken to prevent further encroachments of the Government in business?"

Seventy-two percent of the respondents were absolutely opposed to tax-exempt securities and favored legislation prohibiting their issuance. Seventy-three percent opposed any form of the Government in business, and 53 percent dwelt at length on the necessity for educating the people on basic principles of economics, taxation and government.

Probably as constructive a suggestion as was made, came from a professor of economics, who believes that increase in state and local taxes is not *per se* an evil; but thinks extravagance and waste must be curbed, and can best be checked by discriminating study of public affairs by the electorate, and the faithful exercise of the voting privilege.

The increasing danger of demagoguery lies in the fact that as time goes on, there will naturally be a tendency for many allied industries to combine, and it will be more and more easy for the Government to take them over. Big business should be regulated, but the formation or con-

Mitchell Dam, Coosa River, Ala., Operated by the Alabama Power Co.

* This article is the fourth of a series of five, prepared from information gathered by the Bureau of Mining Economics of The American Mining Congress, on five major national questions.

solidation of business interests should not be prevented.

The mere increase of taxation was not viewed with undue alarm by many, who feel that taxation represents a payment for certain social advantages; the question is, "Are we getting adequate results for the taxes we are paying?"

The general consensus of opinion seems to favor taxation of Federal and other similar securities in the same way that private issues are taxed.

Discussing the constitutional right of "life, liberty and the pursuit of happiness," one correspondent says "The only function of government is to secure and protect the citizen in the enjoyment of those rights. This can be brought about again, if the primary system of nominating a man to public office is repealed."

A prominent banker feels that by abolishing the direct primary and putting administration into the hands of capable people, the Government would automatically cease to be a competitor with private enterprise, since the people themselves would see to it.

Much emphasis was laid by several on the value of local Taxpayers' Associations, and education of the people on these questions by civic clubs and similar organizations.

It would seem sound logic, that since any business, to exist, must show a profit, a publicly owned enterprise should be just as able to pay taxes as a private one, and if it can only exist by having its taxes remitted, it should cease to function.

A producer of raw material, in one of the wasting industries says:

"I believe there should be in each state a commission or commissioner of public works whose duty it would be to pass on all public works within the state in order to assure itself that they were necessary, of proper design and construction and reasonable in cost. No township, borough, city, county or state departments could spend any of the taxpayers' money without the approval of such commission. In addition the assessment districts should be larger with trained employes occupying permanent positions, and the methods of assessing real estate should be the same all over each state. I know no method of preventing further encroachment of Government in business except by constantly educating the taxpayers and voters against it."

Continuation of tax-exempt securities will ultimately create a money oligarchy resulting in a privileged class, is the fear of several; while others feel that all luxuries of life should be taxed, and all necessities should be tax free; the obvious difficulty here being to determine the line of demarcation between the two.

The burden of complaint by many manufacturers is that it is manifestly unfair for one class of people to invest in Government bonds, thereby taking no risk, and paying no taxes, while others take the usual risk of business, pay excessive rates on loans, and are subject to taxation.

Quoting our experience with government operation of railroads and the Emergency Fleet Corporation, it is suggested that the election of officials pledged to the business of government and not to the government of business, would answer the question. The same writer says that state, county and city bonds are going the same route that money went before the Civil War, when all the banks of the country were issuing their own notes.

A comprehensive editorial expression of different hue bears quoting in full:

"I am absolutely opposed to Government ownership of public utility enterprises, of state-operated insurance interests, and of construction or public work of any kind by day labor instead of by contract. More and more this country is becoming centralized under bureaucratic control, and bureaucratic management and control always mean, in my opinion, increased cost, the destruction of private initiative, and the centralization of power in Washington which is putting this country almost as much under bureaucratic domination as is Russia.

"I am not in favor of preventing states and municipalities from issuing tax-exempt securities. I believe that in this way they are enabled to secure money for building of schools and other municipal improvements at a lower cost than would be possible if these securities were not tax free. But more than that, I think that if by any manner of means the Federal Government should have the power to prevent the exemption of state and municipal securities from taxation, it would have the power to absolutely dominate all of their activities, and thus practically destroy states' rights. It is entirely conceivable that under such a control some Federal bureau would be able to say to a city or a state, you must not issue any more securities, and in that way retard their development to their disadvantage, or perhaps to the advantage of other states that might be favored for political reasons. It is needless to remind you that this would be entirely within reason to expect, considering what we are constantly seeing in political activities.

"I do not believe that we can materially curb state and local taxes. We may be able to curb all wasteful use of the money raised by taxes; but, I believe that about one-third of our state taxes go into highway building, and highway building is a creator of wealth and the advancement of civilization. We can not only not curb highway building, but we must double and treble the amount to be expended in highways. We have come upon an entirely new epoch in world affairs where the automobile, the motor bus and the motor truck are changing all social and business conditions, and compelling us, willing or unwilling, to build more and better, and more costly highways. We have also come upon a period when the demand for education seems to know no limit, and we must build more and larger schools, pay teachers larger salaries, and do things which in former times would have been regarded as visionary in our educational activities. Under our compulsory education and child labor laws we are adding enormously every year to the number of scholars in all grades of schools, from primary to colleges and universities. There is an insatiate demand for more education. I believe it is true that in some southern states there are ten times as many students in high schools as there were ten years ago. So far as I can learn, every school, public and private, from the primary schools to high schools and universities, is overcrowded. I saw a few days ago that one Georgia college for women had to refuse admission to 500 students eager for the opportunity of learning. Apparently we can not build schools rapidly enough to keep up with our increase in the number of students.

"The growth of cities is demanding more and better pavement, more complete engineering work for sewerage systems and water supplies. A few years ago a traffic policeman was unknown. Today almost every village of any size must have its traffic policemen at all dangerous corners, and the aggregate number of policemen required for this purpose runs into the many thousands. This is an expense that municipalities never had up to a few years ago.

"In the light of all of these conditions I do not see how we can find any way to lessen municipal or state taxation, and I believe that a great deal of unwise work has been done by those who are constantly harping upon the increase of taxation without at the same time considering the reasons why this increase is necessary."

Carefully differentiating, in the matter of Government operation, another believes that certain fundamental services which are basic public necessities should unquestionably be so operated. The Post Office of course is an outstanding example. Irrigation and reclamation projects are another. Many others lie on the borderline. In recent years water works have come to be considered public functions, and although large numbers of water works are still owned privately, the trend is toward public operation, due of course to the interlocking relation between water supply and the public health. The Panama Canal likewise illustrates the fact that certain projects, by nature of their size or character, are inherently governmental operations.

Interstate power and light manufacture and distribution, interstate railroad operations, traction lines, etc., have become fundamental necessities and call for supervision and regulation but not for governmental operation.

Many editors divide industry into two classes; those requiring profits, and those in which service must come first. They feel that where indispensable service is essential, the Government should operate, regardless of cost, but that wherever operation is purely a matter of profits, individual initiative should control.

An interesting side light on taxation is brought out by the statement that while real estate represents less than half the wealth of any community, it bears 75 per- (*Continued on page* 850)

A PROPOSED PLAN *for the* REHABILITATION *of* HYDRAULIC MINING

By ROY H. ELLIOTT*

Present Condition Of Industry—Water Supplies—Gravel Deposits Available—A Plan For Rehabilitation Outlined Which Includes Government Construction Of Concrete Dams In Accordance With Provisions Of Caminetti Act, And The General Provisions Of The Cloudman Bill

A SHORT review of the history of the hydraulic mining industry in California will help to a clearer understanding of the proposed plan to all who are not thoroughly familiar with this subject.

Hydraulic mining is generally understood to include all mining operations where water is used under pressure through a nozzle to cut down or wash away any bank or gravel or other similar material, which is then passed through a sluice to recover the gold, and the tailings are carried away by gravity.

The Anti-Débris Association was formed in the early '70's, and in 1876 the first suit of importance was decided against the hydraulic mines, represented by the California Mines' Association. This was appealed and reversed, but other actions followed rapidly; the State of California, the counties of Sutter and Yuba, as well as various individuals, appearing as complainants in suits for injunctions and damages against the hydraulic mines in the Yuba River watershed.

Finally on January 23, 1884, Judge L. B. Sawyer, of the United States Circuit Court, granted a perpetual injunction against the discharge of hydraulic mining débris into streams tributary to the Yuba River, to take effect February 1, 1884, against the North Bloomfield Gravel Mining Company, Milton Mining and Water Company, and eight other mining companies. Injunctions against hydraulic mines in other watersheds followed rapidly, and practically all of the larger mines were shut down within a short time.

The gold production of the state dropped from $24,300,000 in 1883 to $13,600,000 in 1884, and to $12,661,000 in 1885.

The investment in the hydraulic mining industry was estimated at somewhere near $100,000,000, including the cost of over 5,000 miles of mining ditches and flumes, also water-storage dams, long bedrock working tunnels, equipment, lands, and so forth. The stoppage of an annual production of eleven or twelve million dollars and throwing of hundreds of men out of work was a heavy economic loss to the state as whole, so that strong efforts were made to find some way to permit the mines to resume operations.

In the meantime, studies of the situation had been undertaken by the state under an act of the legislature of 1878 creating the office of state engineer. William H. Hall was appointed, and, after a thorough examination, reported in January, 1880, that over 40,000 acres of farm and fruit land had been ruined by the flow of mining débris; that approximately 270,000 acres had been damaged, with a total visible loss and depreciation amounting to about $16,000,000. He further stated that if the heavy sands could be kept out of the streams they could easily be brought into excellent condition.

Also several reports were made to Congress by Federal engineers, notably a commission of three army engineers, which reported in February, 1891, in what is commonly known as the Heuer Report, to the effect that great damage had been done to the stream channels and to agricultural lands, and recommended that the débris be restrained by barriers in the canyons of the rivers.

Later in 1891 a convention of miners and farmers at San Francisco asked Congress to accept and adopt the Heuer Report and to pass such laws as might be necessary to put the recommended plan into operation. As a result, the so-called "Caminetti Act" was introduced into Congress in 1892 and passed in 1893.

The Caminetti Act created the California Débris Commission, consisting of three officers of the Engineer Corps of the U. S. Army, to be appointed by the President, and makes unlawful hydraulic mining in the Great Valley Basin except under license from the commission and under conditions approved by them, which prevent further injury to the navigable streams and the lands adjacent to them.

The hydraulic miners expected to revive their industry under provisions of the Caminetti Act to such a stage that a production of several million dollars a year might be expected for a long period, but no appropriations could be obtained for the construction of large dams at points where cheap storage was possible, and, in general, the water-supply systems had deteriorated to such an extent that their operation and maintenance was very expensive. Therefore, no general revival followed, and while some production was made from the richer bodies of gravel until about 1900 by building log-crib and brush dams, even this fell away when the commission, learning from experience that such structures were but temporary and easily destroyed, demanded costly indestructible masonry or concrete restraining dams.

From small and primitive beginnings this method of mining was perfected very rapidly, so that by 1880 it was estimated in that year alone approximately 50,000,000 cu. yds. of material were mined into the streams tributary to the Sacramento River. During the development of this industry on the ridges and higher bars, the soil and gravel containing gold in the various river channels and low bars, and in all the tributary ravines and gulches, was being thoroughly overturned and washed, and largely dumped into the stream beds, by large numbers of miners still using the old hand methods.

The unprecedented floods and high waters of the winter of 1861-62, coming in three great waves, carried an enormous volume of natural and mining

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débris from the mountains into the valley stream channels, filling them to such an extent that riparian owners became alarmed, and with good reason. The mining-débris problem at once became of major importance in the Sacramento Valley, as the material started on its way by the great flood and augmented by yearly increasing volumes of hydraulic mining débris, moved toward the bay, raising the stream-bed levels, flooding and covering farm lands with sand and silt, and making necessary the expenditure of great sums on levees to restrain the streams within their channels.

For nearly 30 years the hydraulic mining industry of California has been dormant along the streams flowing into the Sacramento Valley, except for small and unimportant operations. The only exception is on the North Fork of the Yuba River, where the Yuba Development Company (now Yuba River Power Company) in 1918 constructed a small concrete dam a short distance below Bullards' Bar, and hydraulic mining was resumed on a large scale at the Brandy City mine. This dam was raised to a height of 170 ft. in 1923, providing storage for 80,000,000 cu. yds. of debris, of which 40,000,000 is licensed, the use of the remainder being subject to the later decision of the Federal Power Commission.

The power developed through the water head and storage provided by the Bullards' Bar dam was capitalized to cover nearly the whole cost of the project, the operation of the power plant being turned over to the Pacific Gas and Electric Company.

The construction of the Bullards' Bar dam and the operation of various hydraulic mines above it during the last eight years, under license from the California Débris Commission, is extremely important in connection with the present proposal. The fact that there have been no complaints from the agriculturalists about debris, and the continuous development of power while the mines have been in operation, are the strongest evidence that the proposed construction of similar dams on other streams for the double purpose of debris storage and power development is worthy of investigation and help from the State.

The same company had plans well under way for the construction of a similar but much larger dam at The Narrows, on the main Yuba River near Smartsville, in connection with a large power system along the North Yuba River. It is estimated that this Narrows Dam as projected will ultimately store 350,000,000 cu. yds. of debris, and allow nearly all of the gravels of present economic value in the Yuba River Basin to be worked.

Its construction by the Yuba River Company, however, was delayed indefinitely by the adverse claim made by the Nevada Irrigation District for important high elevation water storage reservoirs.

Stream or watershed	Total yardage available	Probably mineable in 20 years	Estimated yield
North Fork American	115,000,000	23,000,000	$2,640,000
Middle Fork American	30,000,000	13,000,000	1,347,000
Bear River	43,000,000	26,500,000	4,167,000
South Yuba	415,000,000	105,400,000	14,800,000
Middle Yuba	450,000,000	100,000,000	10,500,000
Totals	1,053,000,000	267,900,000	$33,454,000

Water Supplies

The above dispute is mentioned here to more strongly emphasize the fact that we must recognize the inevitable growth of the demand for municipal irrigation and power purposes of the water now remaining available for mining purposes. The Hetch-Hetchy, East Bay Water District, and Sacramento Silver Creek projects will serve as further illustrations.

The length of time which will elapse before the possibility of carrying on hydraulic mining in the Sierra Nevada region will become economically impossible because of the partial or entire withdrawal of the remaining available water supplies to these other uses, is of course now indefinite; but we can pretty safely forecast that it will be short if the present conditions as to mining continue.

On the other hand, if the mines can be reopened and the water put to use in an active and productive industry employing a considerable number of people and contributing materially to the prosperity of a large section of the State, the natural and probable tendency surely will be to prolong that desirable condition so long as possible as against other prospective uses for the water.

Gravel Deposits Available

Space will not permit more than a brief summary of yardages and estimated gold contents of the gravel deposits which might be expected to be mined again if the proposed plan is put into operation. The figures here given have been taken largely from the recent report to the 1927 legislature on this subject, prepared by Mr. Arthur Jarman after an investigation for the Hydraulic Mining Commission as authorized by the legislature in 1926. This report by Mr. Jarman is an able and, in my opinion, very conservative statement of the situation as it now stands.

The figures given by Mr. Jarman for the South and Middle Yuba Rivers have been amended here to include more of the San Juan Ridge gravels. The North Yuba is not taken into account, as its storage necessities are already provided for by the Bullards' Bar reservoir. If the Narrows dam is built, it will take care of both the South and Middle Yuba River drainages, and will do away with the necessity of the Jones' Bar dam or others on the South Yuba, except possibly as a much later development to prolong an industry then in full swing. It seems probable that this should be the case, and that the number of years of operation, particularly in the Yuba Basin, can be extended much beyond the 20-year period above mentioned.

Necessity for Hydraulic Mining

It is claimed that the gold contained in these gravels can be recovered by underground mining, as by using drifting and breasting methods somewhat similar to those used in coal mining, or by dredging. It is true that a large production of gold has been made by drift mines in this State, and probably a small percentage of the gold now contained in the remaining gravels might be so recovered if all hope of mining them by hydraulic methods has to be abandoned. But it must be remembered that the mining of these deposits by drifting and breasting methods has been possible at all times since the Sawyer decision went into effect in 1884, and also that these methods have been tried and abandoned several times on practically every deposit of importance during the years since then.

The trouble is that while the gold is generally found in greatest concentration on and close to the bedrock, and some rich pay streaks have been found and mined out, it is a general condition in these large deposits, and especially those of the San Juan Ridge, that the gold is pretty well distributed through the gravel for many feet above bedrock. On the San Juan Ridge about 150,000,000 cu. yds. of surface gravels, lying 200 to 400 ft. above bedrock, produced from 3 to 5 cents per yard. The average gold content has been shown to be too low to stand the cost of underground mining methods.

Dredging of several of the deposits has been considered at various times, but always turned down because of adverse physical conditions. For instance, the depth of most of these deposits ranges from over 100 to several hundred feet, while the only dredging operation of which I have any knowledge that went over 100 ft. deep found the operating costs so greatly increased by the tremendous wear and strain on the machinery as to make it unprofitable, under otherwise ideal dredging conditions.

Moreover, there are usually other features, such as the presence of many large boulders on bedrock; rough, uneven bedrock; or difficulty in holding flotation water, that definitely preclude the possibility of dredging these old channels.

It is, therefore, the consensus of opinion of all the engineers I know familiar with these gravel deposits that hydraulic mining is positively the only method by which the gold can be taken from them profitably on a large scale.

Recent Governmental Investigations and Reports

There have been many reports upon the hydraulic débris situation by various Federal and State agencies, from that by William H. Smith, in 1880, down to the present. It seems to me that reports dating back more than 10 or 15 years have little more than a historic value in a study of this question, because of the great changes recently in many factors of vital importance, such as improvements in dam construction, greater demand for hydro-electric power and for water for irrigation uses, improvement in stream channel conditions, changes in flood-control plan, and so forth.

In 1905 G. K. Gilbert, of the U. S. Geological Survey staff, was detailed to make a thorough investigation of all phases of the débris situation in the Sacramento Valley. He spent the years 1905 to 1908 in field work and this was supplemented by Gilbert and others during the years 1909 to 1914. The results were published in 1917 as Professional Paper No. 105, under the title "Hydraulic Mining Débris in the Sierra Nevada." This is perhaps the most authoritative source we have for information on the volumes of hydraulic and natural débris and the effects of silting the streams and bays.

A two-page abstract of the volume concludes as follows:

Chapter X—The stress which caused the restriction of hydraulic mining no longer exists. Under conditions to be created by works for the control of floods the capacity of valley rivers for transportation of débris will be increased, so that the mining might be partly resumed without prejudice to any valley interest except navigation. The important interest which now dictates that débris should be controlled is that of the commerce which traverses the Golden Gate. Possibilities for resumption of mining on a large scale, with storage of débris, lie in cooperation with irrigation and electric-power development for the control of Sierra streams.

Hydraulic Mining at Gold Run, Placer County, Calif., 1872

Professional Paper 86, entitled "The Transportation of Debris by Running Water," also by G. K. Gilbert, contains much further information of interest and value regarding the movement and effect of débris in the streams, with special studies of the Yuba River.

In Bulletin No. 92 of the California State Mining Bureau, issued in 1923, under the title "Gold Placers of California," Charles S. Haley has embodied the results of a two-year study of the placer deposits of the whole State, with suggestions for the construction of large restraining and reclamation works in the Yuba, Bear, and American River Basins which would permit the resumption of hydraulic mining and help stream regulation and control.

In the same year the Department of Public Works, through the Division of Engineering and Irrigation, made several reports to the legislature of 1923, including the following:

Bulletin 4. Water Resources of California.

Bulletin 5. Flow in California Stream, or Appendix "A" to Bulletin No. 4.

Bulletin 6. Irrigation Requirements of California Lands.

As a result of the interest created by Haley's report, and possibly because of the direct connection between débris restriction and flood control, which was by then an important issue in the Sacramento Valley, the legislature of 1925 passed a bill constituting the California Hydraulic Mining Commission and appropriated the sum of $10,000 for an investigation of the feasibility of any plan or plans whereby hydraulic mining can be resumed in California.

This investigation was made by Mr. Jarman for the commission, and his report, entitled "Report of the Hydraulic Mining Commission Upon the Feasibility of the Resumption of Hydraulic Mining in California," was presented to the legislature of 1927.

Other recent documents of interest in connection with this subject are:

Letter from the Reclamation Board of California to Hon. C. F. Curry, member of Congress, Third California District, with historical summary of Federal action and its resulting effect upon the Sacramento flood control project, dated February 29, 1924.

Report by W. F. McClure, State engineer, to the Reclamation Board, dated February 10, 1925, on the "Sacramento Flood Control Project."

These last two papers were prepared by Ernest A. Bailey, flood control engineer, at Sacramento.

At the present time the California Debris Commission is preparing a special report to the next Congress. Major Ridley, the secretary of the commission, speaking at a meeting of the local section of the A. I. M. E. in April of this year, mentioned several lines of investigation to be taken up in view of the possible resumption of hydraulic mining and the very much changed conditions since the earlier government reports were made. The rivers have cleared their channels and less water is now available to mine with, and so forth.

The Plan

We have now, I think, a sufficient groundwork for a statement of the plan by which it is proposed to rehabilitate the hydraulic mining industry in California, and at the same time promote the welfare of all other industries, with injury to none.

As set forth by Haley, the plan would embrace the construction by the Federal Government, under the Caminetti Act, of concrete dams at controlling points on the principal hydraulic mining streams for the restraint of both natural and hydraulic debris, the cost of building and

operation to be returned to the Government through a 3 percent production tax on the miner; other barriers on the lower streams provide settling basins for any fine silt to be pumped out and used for reclaiming existing useless swamp lands.

The plan proposed by Jarman is not quite so extensive as that of Haley, but more specific as to its recommendations and workable as to details. It would provide an appropriation by the State to cover costs of the preliminary engineering necessary to secure precise data upon favorable dam sites upon the Bear River, North Fork and South Fork of American River, and to buy the land affected. It is also recommended that storage be purchased behind a dam to be constructed by a private corporation at the Narrows site on the Main Yuba River.

The title to all storage is to be vested in the Federal Government through the California Débris Commission; to be paid for as used by the various mine operators, at a rate per cubic yard to be determined separately for each storage reservoir on the basis of return of capital outlay through the sale of the storage space available in each instance. Surveys of pits and allowances for material permanently stacked at each mine to be as directed by the commission.

The Caminetti Act will have to be amended to allow the purchase of storage in lieu of erection of a dam by each operator; to permit the charge for impounded debris to be based on actual volume used instead of on a 3 percent of gross output basis; and, finally, to permit new plans as approved by the present Débris Commission to be used, rather than plans recommended by the Heuer Commission in 1891, as adopted in section 25 of the act.

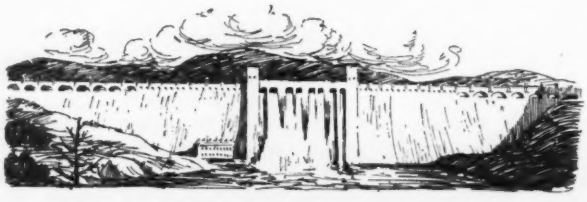
Caminetti Act Provisions

The particular sections of the Caminetti Act most directly bearing upon the operation of this plan are these:

Section 4. That it shall be the duty of said commission to mature and adopt such plan or plans, from examinations and surveys already made and from such additional examinations and surveys as it may deem necessary, as will improve the navigability of all the rivers comprising said systems, deepen their channels, and protect their banks. Such plan or plans shall be matured with a view of making the same effective as against the encroachment of and damage from débris resulting from mining operations, natural erosion, or other causes, with a view of restoring, as near as practicable and the necessities of commerce and navigation demand, the navigability of said rivers to the condition existing in 1860, and permitting mining by the hydraulic process, as the term is understood in said state, to be carried on, provided the same can be accomplished without injury to the navigability of said rivers or the lands adjacent thereto.

Section 5. That it shall further examine, survey, and determine the utility and practicability, for the purposes hereinafter indicated, of storage sites in the tributaries of said rivers and in the respective branches of said tributaries, or in the plains, basins, sloughs, and tule and swamp lands adjacent to or along the course of said rivers, for the storage of débris or water or as settling reservoirs, with the object of using the same by either or all of these methods and to aid in the improvement and protection of said navigable rivers by preventing deposits therein of débris resulting from mining operations, natural erosion, or other causes, or for affording relief thereto in flood time and providing sufficient water to maintain scouring force therein in the summer season; and in connection therewith to investigate such hydraulic and other mines as are now or may have been worked by methods intended to restrain the débris and material moved in operating such mines by impounding dams, settling reservoirs, or otherwise, and, in general, to make such study of and researches in the hydraulic mining industry as science, experience, and engineering skill may suggest as practicable and useful in devising a method or methods whereby such mining may be carried on as aforesaid.

Section 25. That said commission, in order that such material as is now or may hereafter be lodged in the tributaries of the Sacramento and San Joaquin River systems resulting from mining operations, natural erosion, or other causes, shall be prevented from injuring the said navigable rivers or such of the tributaries of either as may be navigable and the land adjacent thereto, is hereby directed and empowered, when appropriations are made therefor by law, or sufficient money is deposited for that purpose in said débris fund, to build at such points above the head of navigation in said rivers and on the main tributaries thereof, or branches of such tributaries, or at any place adjacent to the same, which, in the judgment of said commission, will effect said object (the same to be of such material as will insure safety and permanency), such restraining or impounding dams and settling reservoirs, with such canals, locks, or other works adapted and required to complete same. The recommendations contained in Executive Document Numbered Two Hundred and Sixty-seven, Fifty-first Congress, second session, and Executive Document Numbered Ninety-eight, Forty-seventh Congress, first session, as far as they refer to impounding dams, or other restraining works, are hereby adopted, and the same are directed to be made the basis of operations. The sum of sixteen thousand dollars is hereby appropriated, from moneys in the Treasury not otherwise appropriated, to be immediately available to defray the expenses of said commission.



From the above it will be seen that it is mandatory upon the commission to so conduct its engineering investigations and operations as not only to improve the navigability of the streams and protect their banks but also to make such study of the hydraulic mining industry as practicable in devising methods whereby such mining may be carried on without injury to the navigability of the rivers or the lands adjacent thereto.

It is also specifically directed, "when appropriations are made therefor by law . . . to build . . . such restraining or impounding dams and settling reservoirs . . . ," as "in the judgment of said commission will effect said object (the same to be of such material as will insure safety and permanency)."

The Cloudman Bill

Assembly Bill No. 681 was introduced by Mr. Harold C. Cloudman on January 20, 1927, to bring this matter before our last, or 1927, legislature then in session. The final form after amendment in the assembly was as follows:

An act appropriating money to be used for the purchase of dam sites and other necessary land to restrain tailings from hydraulic mining operations and for engineering investigations in connection therewith.

The people of the State of California do enact as follows:

Section 1. The sum of two hundred thousand dollars is hereby appropriated out of any money in the state treasury not otherwise appropriated, to be expended, in accordance with law, under the supervision and control of the state board of control upon the recommendation of the California Débris Commission for the purposes of purchasing dam sites and other necessary land to restrain tailing from hydraulic operations and for the conducting of engineering investigations of said California Débris Commission in connection therewith.

Section 2. The title to all land so purchased by the State of California upon recommendation of the California Débris Commission, under the provisions hereof, shall immediately upon the purchase thereof by the state, vest absolutely and unqualifiedly in the Government of the United States for the purposes above designated.

In this form it was passed by a good majority of the assembly, after a public hearing before the joint houses, and went up to the Senate Committee on Mines and Mining, by which it was approved and passed out. As an appropriation measure, it was referred to the Senate Committee on Ways and Means, which laid it upon the table after limiting the hearing on it to 10 minutes for each side. It was brought out of the committee by resolution in the Senate, but on the final roll call failed of passage by a single vote, the count being 20 ayes and 18 noes, 21 being necessary to pass it.

It is proposed to present the bill (*Continued on page* 850)

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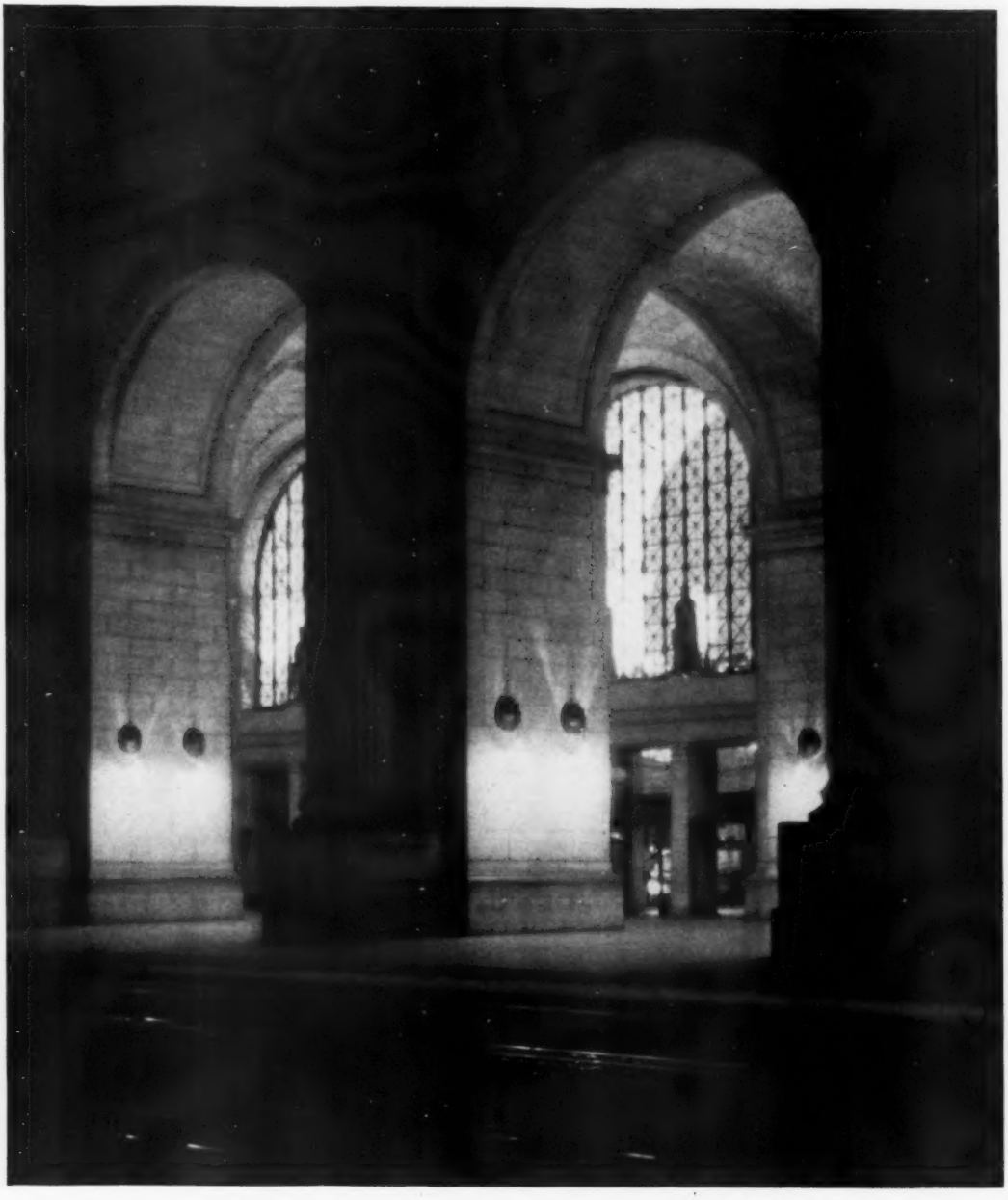


Entrance to Washington's Great Railroad Terminal

From "Washington, Our National Shrine," by Charles Colfax-Long.

REPORTS ON THE MECHANIZATION SURVEY

Room And Pillar Mining With Loading Machines—Draw Slate And Bad Top—Advancing Longwall With Conveyors—Collapsible Jacks On Long Faces

By G. B. SOUTHWARD

The four reports on mechanized mining which are submitted in this issue each illustrate some unusual feature either in the mining method, the physical conditions or the type of equipment.

The two reports on room and pillar mining show mechanical loaders. One of these illustrates a method of timbering and shooting which is designed to meet draw slate and bad top. The other describes an operation in which the loading machine is supplemented by a movable steel hopper and loading boom into which the loader discharges while the mine cars are being shifted.

The two reports on conveyor mining show long face operations under two distinct types of roof. In one of these the roof is supported by collapsible steel jacks which cause roof breaks without bending along the faces. The other is advancing longwall with haulways maintained by packwalls through the gob, using timbers and packwalls along the face to cause roof bending and subsidence.

IN the four reports on mechanized mining which are submitted with this article, Nos. 24 and 38 illustrate the use of mechanical loaders in room and pillar mining, and Nos. 219 and 323 the use of conveyor mining on longwall or long faces. All of these reports show operations which have some unusual feature or some departure from ordinary mining practices as used in this country.

The operation shown in report No. 24 uses a booster in connection with a loading machine. This booster is a movable steel hopper into which the loading machine discharges and this hopper by means of a conveyor loads into mine cars. The hopper has a capacity slightly greater than one mine car and the conveyor operates at a speed or capacity which is about double that of the loading machine rate. If it were not for this increased conveyor speed, there would be little advantage in having a booster, but as it now is the loading machine fills the hopper while the mine cars are being changed and when an empty is placed it is loaded in about one-half the time that it would be loaded direct from the loading machine. By means of this device a part of the usual delay encountered in changing mine cars at the loading machine is eliminated, and the management reports that this has increased the production of a machine operation about 25 percent.

The operation covered by Report No. 38 shows a loading machine under worse top conditions than are generally found where this type of equipment is used, and a very interesting solution for the difficulty has been worked out at this mine. The roof here has a draw slate about 12 inches in thickness, which usually comes down when the coal is shot across a full room width. This draw slate situation is frequently complicated by bad top above the slate and a combination of these two conditions requires very careful handling. The method of timbering and shooting, as illustrated in the sketch and text of the report, is fairly successful, but not uniformly so, as the draw slate is at times so soft that it will fall in a very narrow space. In such cases, the slate is removed from the coal by hand before the loading machine starts. The roof conditions at this operation are a considerable handicap for mechanized mining. However, these same conditions have to be met at this mine whether the loading is by hand or machine, and while the results here may not compare favorably with those obtained under better conditions at other mines, the management reports that their mechanical loading is competing successfully with their hand loading.

The long face operation illustrated in Report No. 219 was designed to meet certain seam and roof conditions, and it is of considerable interest to know that the conveyor faces were installed and are working successfully in a section of a mine that was abandoned several years ago because the conditions were so severe that hand loading into mine cars was no longer profitable. Under the present plan, the faces are mined advancing, leaving between adjacent faces a barrier pillar which is intended to be recovered later by a retreating face after the panel barrier has been reached by the advancing mining. This feature of the system has not yet been proven, as all the mining so far has been on the advancing faces. The roof along the faces is supported as an overhang by steel jacks, which maintain the top out from the face for a distance of about 20 feet. The top is brittle and will break along the face if the supports are not sufficiently rigid to prevent bending, and the management at this operation have demonstrated to their own satisfaction that a favorable roof action is possible only when the top is held rigidly by supports which will not compress. In order to meet this condition, the steel jacks were designed, and these are made collapsible so that a row may be taken out in a comparatively short time under roof weight. This eliminates one difficulty usually encountered when cribs or timbers are employed, as the labor of removing the jacks under roof weight is negligible as compared to the labor ordinarily required to remove timbers or cribs under similar conditions.

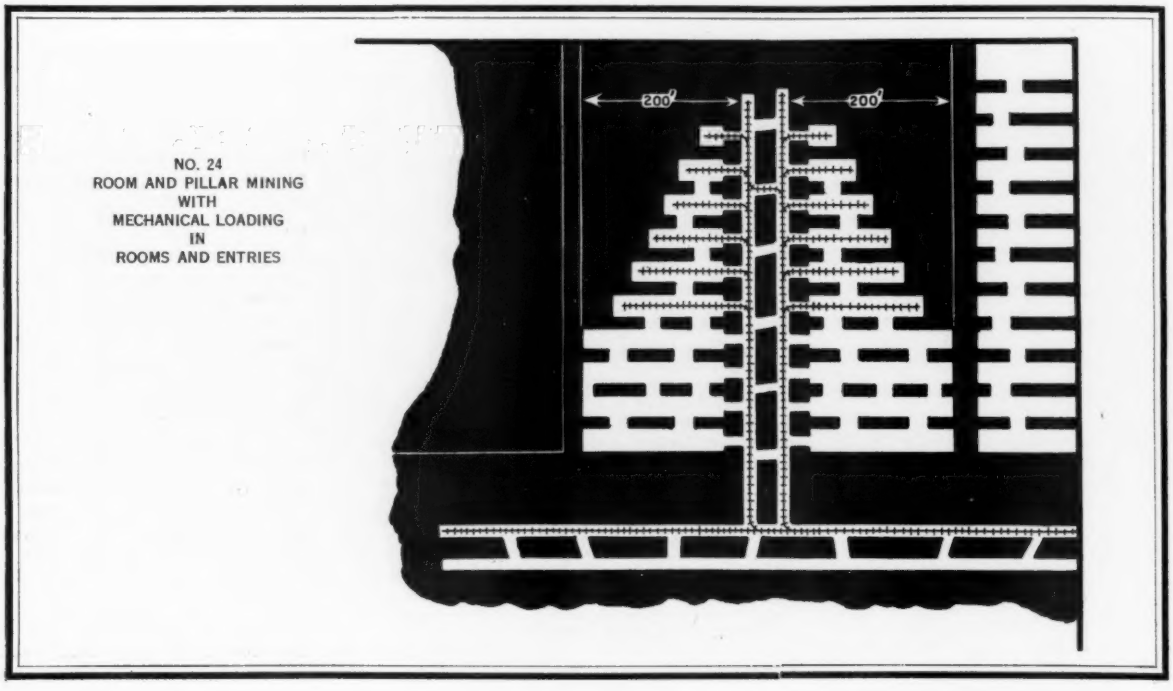
The operation described in Report No. 323 is a true longwall, with the faces worked advancing from the main slope and with haulways maintained by packwalls extending back through the gob. The faces are at stepped intervals, usually about 250 feet apart, and the correct interval has been determined by operations extending over a period of several years. It has been found here that the roof action is favorable when the steps between the faces is greater than 250 feet or less than 50 feet. In other words, a series of faces must be carried either at short intervals, so as to form an approximate straight wall or else the interval must be sufficiently great so that the roof action on one face is not affected by any action or weight on the other. It has also been found at this operation that there is equally favorable roof action whether the faces are worked down or up the pitch.

An unusual feature here is that the coal along the faces is not broken down by explosives. The small sizes of coal are not readily disposed of in the market available for this output and the management finds it profitable to break down the coal by hand in order to secure a high percentage of lump.

These four operations are working under such different conditions, that any attempt to compare the efficiency of one with the other may result in misleading conclusions. The comparison that can be of value is between the mechanized operation and hand loading at each of these mines. In the two longwall operations the managements report that hand mining under their conditions would be unprofitable and prohibitive. The two room and pillar operations report that the mechanized mining is showing marked economies over previous hand-loading records.

V 13 11 NOV 1

Report No. 24



PHYSICAL CONDITIONS: The seam varies from 5 to 6½ ft. in height; of medium hard coal with small intermittent partings. A draw slate occurs irregularly, varying from zero to 12 in. in thickness, and above this there is a slate top which generally stands well with light timbering. Soft fire clay bottom. The seam is generally level but there are areas with rolls or pitches up to 10 percent. Cover 50 to 100 ft. Open lights.

MINING SYSTEM: Room and pillar advancing with the machine loading in rooms and entries. Panels 450 ft. wide developed by a pair of entries in the center with rooms to the right and left. Rooms are 28 ft. wide on 33-ft. centers and 200 ft. long. One loading machine is used in a panel, driving the entries and working rooms on each side of the entries.

MECHANICAL OPERATION: The loading machine works on caterpillars which are set at track gauge for moving from place to place, and a single track of 20-pound steel on 42-in. gauge is laid in each room. Mine cars of 2¼-ton capacity are placed at the machine one at a time by a gathering locomotive; one locomotive serving each machine.

Two different methods for loading mine cars are used. In one method the loader discharges directly into the mine car and in the other it discharges into a "booster." This is a steel hopper of slightly over one mine car capacity with a conveyor in the bottom which conveys from the hopper and loads into a mine car. The capacity of the "booster" conveyor is about twice that of the loading machine conveyor, consequently a car is loaded very quickly from the hopper and the loading machine continues its operation while the mine cars are being changed. The "booster" is mounted on trucks propelled by motor; one operator is used to keep the hopper under the discharge end of the loading machine conveyor during the operation. It is estimated that the "booster" increases the output from the loading machine at this mine by about 25 percent.

The coal is undercut 6½ ft. by machine, and 3½-in. diameter holes are drilled with an electric drill for shooting. Black powder is used with three shots in each room; using about 25 pounds to produce 100 tons of coal. The coal is shattered in a standing shot and more or less digging is required by the machine.

TIMBERING AND ROOF ACTION: No pillars are being drawn as the light cover permits a high rate of extraction in the room mining. Two rows of light timbers are sufficient to maintain the top in the rooms except in some bad top areas where additional timbering is required.

OPERATING CREW: All work is done on the day shift of eight hours with the exception of shooting, which is done immediately after the day shift is over. The cutting, drilling and other dead work follows directly behind the loading machine. Each loading machine has one operator, and where the "booster" is used one "booster" operator; one helper who also acts as trip rider; one motorman, two hand loaders, two cutting machine men, one driller, one trackman and one slateman. This makes an average of 10 men for a regular operating crew and 11 men where the "booster" is used. A machine will ordinarily load about 5 places without the "booster" and about 7 places with the "booster," in one shift, each place producing from 25 to 30 tons.

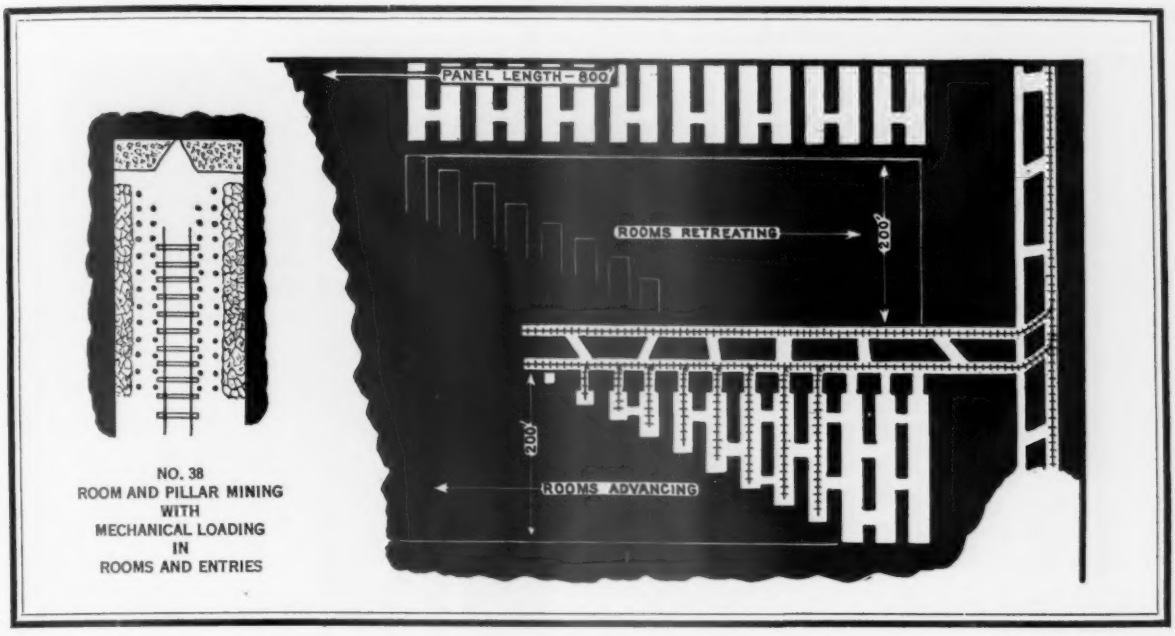
EQUIPMENT: An operating unit requires 1 loading machine, 1 booster, 1 cutting machine, 1 electric hand drill, and 1 gathering locomotive.

PREPARATION: Some slate picking is done inside, particularly where draw slate occurs, but a modern air cleaning plant on the surface is used to remove impurities from the smaller grades of coal. A few additional slate pickers over what were formerly required on the tipple in hand mining are used for the large sizes. The management reports that the percentage of lump obtained with machine loading compares favorably with that obtained by hand mining and with their air cleaning plant a very satisfactory product is being prepared.

CONCLUSION: Mechanical loading has been in use at this mine for over two years and this mine is now practically on a 100 percent mechanical basis. The management reports the operation is satisfactory and successful in the areas where the seam is normal and the number of working places has been reduced to one-third of the number formerly required to produce the same tonnage by hand mining.

Upkeep and maintenance on the loading machines has now reached a point where it compares very favorably in cost with the same service on cutting machines used. Somewhat closer supervision is required in mechanical operation, as compared with hand loading. This, with the great gain in concentration of operation, makes for a better chance to avoid accidents, and enhances the safety factor.

Report No. 38



PHYSICAL CONDITIONS: The seam averages slightly less than 5 ft. in height, of hard structure coal with 1 to 3 in. of bone parting. The top is a draw slate 12 in. in thickness above which is stratified slate and coal from 4 to 10 ft. in thickness. The roof is difficult to maintain and requires considerable timbering in the rooms and headings. Hard clay bottom. Seam approximately level. Cover 100 ft. Open lights.

MINING SYSTEM: Room and pillar with mechanical loading in rooms and entries. Panels 800 ft. long by 450 ft. wide developed by a pair of entries in the center with rooms 24 ft. wide on 32-ft. centers driven 200 ft. to the right and left off the entries. While the heading is being developed, rooms are worked advancing on one side only, and when the panel limit has been reached the rooms on the other side of the entry are worked retreating. One loading machine is used in a panel driving the entries and working the rooms, having ordinarily nine rooms under development as a working territory.

MECHANICAL OPERATION: The loading machine works on caterpillars and moves from place to place on the mine tracks. The machine loads into cars of 3¼-ton capacity, which are delivered one at a time by a gathering locomotive, one locomotive serving each machine. The cars are shifted into one of the adjoining rooms during the loading operation and are hauled in 6-car trips by the gathering locomotive to the main line sidetrack. A single track of 25-lb. steel on 42-in. gauge is laid in each room.

All coal is undercut 6 ft. by machines and is shot with permissible explosive and electric firing. Five shots are used in a room; the first or snubbing shot is placed near the center of the room and is followed by two shots on each side. Shooting is done on the day shift during the loading operation and the coal from the snubbing shot is loaded out by the machine before the side shots are fired. This method of shooting and loading is necessitated by the bad top and allows timbers to be set close to the face during the loading operation. About two sticks of powder are used in each shot, which produces from 10 to 15 tons of coal per pound of explosive used.

TIMBERING AND ROOF ACTION: The top is a draw slate about 12 in. in thickness, which, in most cases, comes down when the coal is shot, although with the method of shooting described above there are times when this slate can be held in place until the coal has been loaded. Above the draw slate the top is bad and requires careful and systematic timbering, which must be maintained close up to the working face. This top has presented a serious difficulty to mechanical loading, but the method of timbering devised at this operation has proved fairly successful.

The track is laid in the center of the room with two rows of timbers on each side between the track and the rib. Posts from 4 to 6 in. diameter are set every 3 ft. as the room advances. Two middle rows of timber are set on each side of the track and 4 ft. from the center of the track, so as to provide just sufficient clearance for the mine cars and the loading machine to pass. Between this row and the rib is another row of timbers. The two middle or track rows of posts extend to within 6 ft. of the face of the coal before it is shot down; the two outer rows extend to within 3 ft. of the face, thus leaving space free of timbers from the track to both corners of the room in which the loading machine shovel is free to swing during the loading operation. By starting the shooting and loading in the center of the room and working to the rib, the timbers on one side of the room may be set during the loading operation.

No pillars are recovered, as the light cover permits a high percentage of extraction in the first mining.

OPERATING CREW: All work is done during the day shift of eight hours with the cutting, drilling and track work following directly behind the loading machine. Each operating unit has 1 machine operator and 1 helper, 2 on the gathering locomotive crew, 3 slatemen who work either with or behind the machine, throwing back and gobbing the draw slate as the occasion requires, 1 shot firer, 1 track layer, 1 timberman, and 2 cutting machine men who also do the drilling. This makes a total of 12 men in the regular crew, who will ordinarily load out two entries and from 4 to 5 rooms during the shift. The amount of coal loaded depends to a large extent upon the amount of draw slate which has to be handled; an average for one year's operation amounted to 130 tons of coal per day. Under favorable slate conditions this will be increased to 150 to 175 tons per day.

EQUIPMENT: Each operating unit has 1 loading machine, 1 cutting machine, 1 electric drill and 1 gathering locomotive.

CONCLUSION: Mechanical loaders have been in use at this mine for about two years, and a large portion of that time was experimental in devising a satisfactory method of timbering and handling slate. About 16 percent of the output of the mine is now being loaded mechanically, and the management feels that their present operation is demonstrating that mechanical loading is successfully competing with hand-loading under their severe roof conditions.

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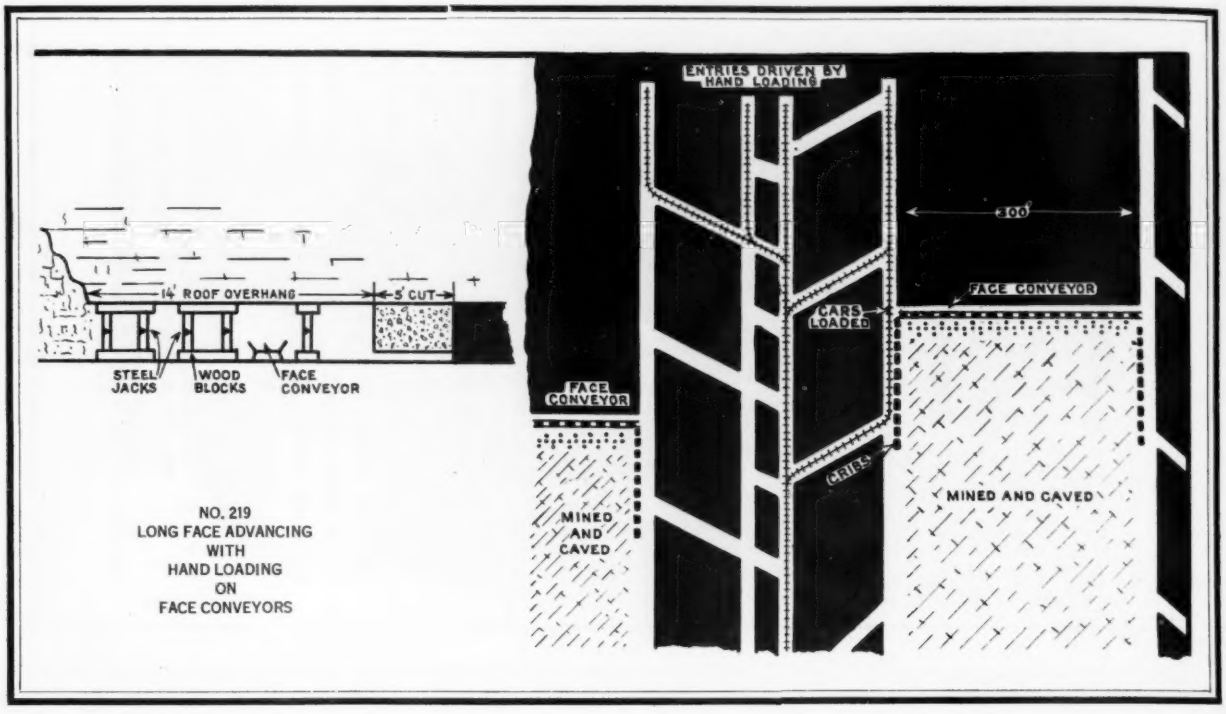
Report No 219



PHYSICAL CONDITIONS: The seam normally averages from 38 to 42 in. in height, of medium hard coal. The bottom, however, is very irregular with slate rolls cutting out the coal and reducing the height in some cases down to 18 in. The seam lies fairly level but the bottom rolls give the effect of a continually changing grade. The top is a slate which stands well in the headings and along the faces and breaks in the mined area. Cover from 300 to 500 ft. Closed lights. Rock dusting. Slate and bottom coal is taken for height along the entries but not in the face workings.

MINING SYSTEM: Long-face advancing with hand-shoveling on conveyor. Entries are driven by hand-loading in mine cars. The faces are 300 ft. long, mining advancing and developed by a system of four entries between adjacent faces. When the advancing mining has reached the panel limit it is the intention to recover, by a retreating longwall face, the chain and barrier pillar which is left 300 ft. wide between each two advancing faces.

MECHANICAL OPERATION: Each face conveyor is a sectional drag chain type, connected to form a single unit 300 ft. long. This is loaded by hand shoveling and transports coal along the face discharging into mine cars along the haulway. The conveyor is laid parallel to and about 4 ft. from the face before the coal is shot down and is moved forward in a complete unit after each cut is loaded out.

Mine cars of 1 1/3-ton capacity are delivered at the conveyor discharge in 30-car trips by a gathering locomotive, which remains coupled to the trip and moves the cars under the discharge end of the conveyor while loading. Track along the haulway is laid with 40 lb. steel on a 36-in. gauge.

The coal is machine undercut 5 ft. and because of the frequent bottom rolls a considerable part of the undercutting is made in the bottom slate. The face is drilled by an electric hand drill and shot with permissible explosive and fuse firing. The shots are spaced from 5 to 6 ft. apart along the face.

TIMBERING AND ROOF ACTION: The roof is worked on the caving system and is supported as an overhang along the face by five rows of steel jacks set parallel to the face. The first row is set between the conveyor and the face with the jacks on 6 ft. centers; these act as safety posts rather than main roof supports. Behind the conveyor four lines of jacks are set in two double rows, each double row consisting of jacks set in pairs 3 ft. apart on a wood base and cap block. The pairs are on 4-ft. centers measured parallel to the face and the last line of jacks is about 14 ft. from the face before the undercut is made. This is the line on which the roof breaks. After a face is loaded out and the conveyor has been moved forward this double row of jacks is removed and set ahead of the intermediate row, and the intermediate row then becomes the break line for the next roof fall. The jacks are collapsible and are easily removable under heavy roof weight.

The management reports that the roof action on the faces with this system of roof support has been fairly favorable, that there has been very little interruption to the face mining over a long period of operation and that no jacks have been lost by roof falls. A line of cribs is set along the entry at the end of the face to protect and maintain the haulway back to the first breakthrough. These cribs are not recovered.

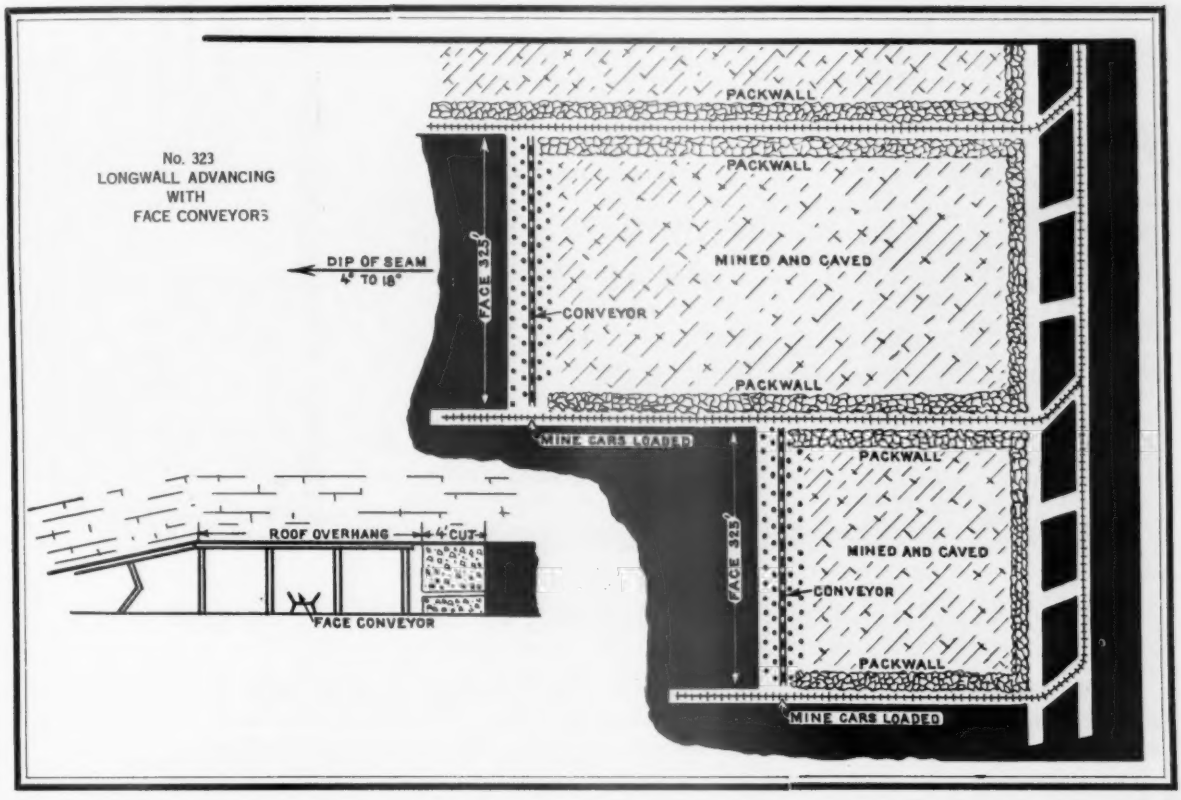
OPERATING CREW: The work is carried on two shifts of eight hours each. The day shift does the loading, drilling and moves forward the face conveyor and resets the row of face jacks. The night crew does the cutting, and moves and resets the rear row of jacks and builds the cribbing along the haulway. A shot firer shoots the faces after the regular night crew have completed their work. Eight loaders and one foreman are used on the day shift with one driller for half the shift; six timbermen, two machine cutters, one shot firer and one foreman are on the night shift. This makes a total of 19½ man-shifts employed as a regular crew on each face to complete cycle of operations. There is also a gathering locomotive crew of two men, the triprider acting as car trimmer at the conveyor while the cars are being loaded. Each face cut will produce about 200 tons of coal when the seam is at its normal height of 38 in.

EQUIPMENT: Each face uses one conveyor 300 ft. long, one cutting machine, one gathering locomotive, one electric hand drill and 350 steel jacks.

PREPARATION: The management reports that a higher percentage of lump coal is produced by this operation than would be obtained by hand mining. Any impurities which occur in the coal and machine cuttings made in the bottom slate are cleaned inside the mine by the face loaders and no additional slate cleaning labor or equipment has been added on the tipple by reason of mechanical operation beyond those originally used for room and pillar mining.

CONCLUSION: This method of mining has been in operation for over a year and all coal now produced at this mine is from conveyor faces or from development for conveyor faces. The management reports this system successfully mining an area where the physical conditions were so severe that hand mining was considered prohibitive and it is estimated that the time required for development to the present output was but 30 percent of the time that would have been required to develop for the same daily capacity by hand mining.

Report No. 323



PHYSICAL CONDITIONS: The seam will average about 54 in. in height with a 6-in. rash parting near the top and a slate and rash parting, which at times has a thickness of 16 in., near the bottom. The coal has a medium hard or tough structure. The top is a fairly hard slate, averaging 4 ft. in thickness—but increasing at times to 20 ft.—above which is a heavy sandstone. Medium hard fire clay bottom. The seam pitches from 4 to 18 degrees. Cover 600 to 800 ft. Open lights. Entries sprinkled.

MINING SYSTEM: Longwall advancing with hand loading on face conveyors. A haulway at the end of each face is maintained by packwalls back through the gob to the main slope. Faces 325 ft. long are worked advancing and adjacent faces are stepped at from 200 to 300 ft. intervals. A single entry at the end of each face is kept advanced about 100 ft. beyond the face to provide standing room for a trip of mine cars to be loaded at the discharge end of the face conveyor. The faces are worked parallel to the strike of the coal, generally advancing up the pitch of the seam, but in several instances faces have been worked down the pitch. In such cases the roof action has proved equally favorable with the up-pitch mining.

Bottom and at times some top is taken for height in the entries and cribs and used for packwalls along the haulways.

MECHANICAL OPERATION: Each face conveyor is a sectional shaking type, connected in single unit 325 ft. long laid parallel to and about 4 ft. from the face. This is loaded by hand shoveling and transports coal along the face and discharges into mine cars along the haulway. Mine cars of 1¼-ton capacity are placed and loaded in 8-car trips, moved by a rope hoist set at the main heading and delivered to the main side track. Track of 25-lb. steel rail on 36-in. gauge is used along the haulway.

The coal is machine cut 4 ft., cutting in the parting near the bottom of the seam, but because a high percentage of lump coal is desired there is no regular shooting except occasional shots to break large lumps or a hanging face. The weight due to the roof pressure tends to bring down the coal after the undercut is made, and this is broken up by hand into small sizes for loading.

TIMBERING AND ROOF ACTION: Cribs and packwalls are built paralleling the haulway at the end of each face and round timber posts are used along the faces. These posts vary from 6 to 8 in. in diameter, and are set on 4-ft. centers in two rows after each cut. Light cross bars are used across the space between the parallel rows. The first row of timbers is set close to the face, between the conveyor and the face, so that it is necessary to disconnect the conveyor to move it forward after a cut is loaded out. Occasional cribs are set along the face as a "cushion" to cause roof subsidence and to prevent an abrupt break. No timbers are recovered, but are left in place until crushed by the roof weight.

Longwall mining has been used at this operation for a number of years, and the management reports that the roof action during this period has been satisfactory with a very small percentage of faces closed by roof falls.

OPERATING CREW: All loading is done on the day shift of 10 hours, with cutting, timbering, and moving conveyor on the night shift. The day crew has 12 loaders, 1 conveyor operator, 1 car hoist operator, 1 cribman, 1 conveyor maintenance man, and 1 timberman. The night crew uses 3 men on the cutting machine, 3 shoveling and gobbing the machine cuttings, 3 timbermen and 4 men to disconnect, move and reset the face conveyor. This makes a force of 30 men employed in the regular daily face operation, but it should be pointed out that considerable extra labor is required to hand break and clean the coal. In addition to the face men, 2 hand loaders drive the single entry. Under normal average conditions a face will advance about 100 ft. per month, producing about 115 tons per face clean up, which is ordinarily made each day during a 10-hour shift.

PREPARATION: The management reports that by their system of longwall mining a higher percentage of lump is obtained from the faces than would be produced by room and pillar mining. Considerable slate cleaning is done by hand inside the mine, but hand picking tables for the larger sizes and a coal washing plant for the smaller sizes is used on the surface to insure satisfactory preparation.

EQUIPMENT: Each face operation has 1 sectional shaking conveyor 300 ft. long, 1 coal cutting machine and 1 electric hoist.

CONCLUSION: Longwall mining has been used at this operation for more than 20 years, and within the last eight years these conveyors have been installed and operated continuously. All coal now being mined is from conveyor faces, and the management reports this operation satisfactory and successful in enabling them to mine a seam where the steep pitch and low height would be prohibitive for hand loading in mine cars.

COAL

PRACTICAL OPERATING MEN'S DEPARTMENT

NEWELL G. ALFORD, Editor

Practical Operating Problems of the Coal Mining Industry

THE LONDONDERRY COLLIERY, DURHAM, ENGLAND*

In The Sinking Of The Shaft Of This Colliery The Engineers Were Faced With The Problem Of Passing Through Large Strata Of Water Which Were Affected By The Tide—The Freezing System Was Adopted—Difficulties Encountered And Met in Sinking The Shaft Explained

THIS new winning, consisting of two pits, known as the Vane and Tempest pits, is being sunk for the purpose of winning and working inland and undersea coal lying on the north side of a large fault which intersects the Seaham Royalty, practically dividing it into two equal portions.

The fault, which runs in an easterly and westerly direction, is a "dipper" to the north. In the vicinity of the Seaham Colliery it has a throw of 105 ft., while near to the coast it has a throw of upwards of 600 ft. The coal measures dip normally to the east at the rate of about 2 in. per yard. Between the new winning and the fault the measures dip in a southerly direction 9 in. per yard or thereabouts.

The site of the new winning is 350 yds. west of high water mark and 70 ft. or thereabouts above this datum.

The following workable seams will be passed through in the pits:

Five Quarter..	251 fathoms from surface
Main Coal.....	278 fathoms from surface
Maudlin	287 fathoms from surface
Hutton	309 fathoms from surface
Harvey	336 fathoms from surface
Busty	350 fathoms from surface

The Maudlin and Hutton seams have to some extent been worked to the Seaham Colliery. Workings were abandoned some years ago for economic reasons.

The new pits will be 200 ft. apart, each having a finished diameter of 21 ft. The south, or Vane pit, will be the down-cast and chief coal-drawing pit.

The north, or Tempest pit, will be used as an upcast, also for the raising and lowering of the workmen and for coal drawing.

The first sod was cut by Lord Castlereagh on December 19, 1923.

A trial borehole was in the first instance put down to prove the thickness of the water-bearing strata, which was found to be 485 ft., of which 425 ft. consists of magnesian limestone with 40 ft. of sand between the base of the limestone and the coal measures.

The water met with in the boring was found at "sea level" to be salt and that it altered in level to an extent of 3 ft. with the rise and ebb of the tide, thus indicating that the fissures in the limestone communicated with the sea.

Having regard to the large feeders of water likely to be met with in sinking through the Permian formation, also the nature of the yellow sands as disclosed in the trial borehole, together with the close proximity of the winnings to the sea, it was decided to freeze the measures.

A contract was entered into with Messrs. The Trefor Boring Company and The Franco Belge Freezing and Sinking Company (both Belgian firms), who are acting jointly as contractors for boring and sinking through the Permian formation into the coal measures.

For the purpose of freezing, 33 boreholes were decided upon for each pit, 32 being spaced out at regular intervals around an outer circle of 30 ft. diameter for freezing purposes, the remaining hole being bored in the center of the pit for inspection purposes during the process of freezing.

Prior to the boring the pits were sunk 39 ft. 6 in. in diameter to a depth of 16 ft. for the purpose of fixing guide tubes for the boring and to admit of connections for freezing tubes with the necessary valves, etc.

A concrete platform was laid around each pit at the surface level having a radius equal to the full length of the boring derricks and their engine houses. Five concentric rings consisting of flat-bottomed steel rails were partly embedded in the concrete at regular intervals to facilitate the removal of the derricks from one hole to another. Three boreholes are bored at one time.

The boreholes were bored from the surface with an 8-in. diameter H-shaped chisel provided with chambers on either side through which the boring water could be discharged.

The rods attached to the bits were hollow, having an inside diameter of 2 in. to allow passage for the flushing water.

* Submitted to The Mining Congress Journal by Mr. E. J. Newbaker, General Manager, Berwind White Coal Mining Co., Windber, Pa., through the courtesy of the Franco-Belge Sinking Co.

The water used for flushing purposes was pumped from the sea by a turbo pump placed upon the beach. The water used in boring rarely appeared on the surface, evidently disappearing in the fissures.

The 8-in. holes were bored to as great a depth as was possible (generally about 300 ft.) when they were altered to holes of 6-in. diameter. The holes were lined with steel tubes which were afterwards withdrawn to permit of the insertion of the freezing tubes.

With the exception of the center hole, all holes were bored to a depth of 535 ft., thus penetrating into the coal measures 50 ft.

The greatest distance bored in one shift of 8 hours was 150 ft. The average rate of boring, including the insertion of the tubes, was approximately 42 ft. per day of 24 hours.

Boring operations around the Tempest pit began on October 29, 1924, and finished on September 9, 1925.

Boring around the Vane pit commenced July 1, 1925, and finished February 11, 1926.

For the purpose of freezing, as each borehole was completed an outer tube 5 in. in diameter, with the bottom end sealed, is lowered into the hole. Inside this tube is inserted another tube 2 in. in diameter with the bottom end open. These two are coupled up to cast-iron collecting pipes with branch pipes and valves which encircle the shaft in the freezing cellar. The collecting pipes are coupled up to the intake and return pipes to and from the refrigerating house.

After the insertion of the freezing tubes the lining tubes were withdrawn from the holes.

The freezing machinery is in three units, each unit consisting of steam driven double acting compressors with ammonia vaporizers and condensers.

The total freezing capacity of the three machines is 450,000 negative calories at 20° Centigrade.

The freezing operation is as follows: The brine, consisting of 1.25 solution of calcium chloride which has been previously cooled, is pumped into the intake main by double acting steam pumps. It passes down the inner tube in each hole and returns through the outer tube, extracting heat from the strata in its passage. The brine returns to the vaporizers, in which are placed coils containing ammonia liquid which vaporizes at a very low temperature, where it is cooled and returned to the boreholes. The vaporizing of the ammonia is obtained by means of gas pumps which create a depression causing vaporization. The ammonia gas is pumped through a water cooler serpentine where it is liquified and returned to the vaporizers.

The freezing of the Tempest shaft was completed and sinking operations commenced February 16, 1926. The shaft was sunk from the surface to within 10 ft. above water level, 26 ft. in diameter, to admit of walling 18 in. in thickness. A water garland was laid at this point and the walling carried up to the surface. The space behind the brickwork was carefully packed with boiler ashes. At a depth of 48 ft. a large cavity was encountered in the limestone which crossed the shaft and exposed the freezing tubes on the north and south sides. This was filled up solidly with concrete to prevent any surface subsidence.

Upon completion of the walling sinking was resumed, the shaft now being approximately 23 ft. in diameter. The ground was found to be well frozen and the sinking quite dry. At a depth of 109 ft. the first cast-iron tubbing curb was laid and the tubbing built upon it up to the walling.

The cast-iron curb was of the box section, 1 ft. 9 in. wide by 10½ in. deep, the metal being 1¾ in. thick with the necessary strengthening ribs. Sixteen segments form a complete circle.

The tubbing is 2 ft. deep, likewise 16 segments forming the circle of the shaft. All the courses were laid upon yellow pine sheeting ⅜ in. thick and the full width of the tubbing flanges. Sheeting was likewise inserted in the vertical joints.

As the tubbing was built up the space between it and the wall sides was packed with sand and gravel from the beach. Upon completion of the tubbing all joints were wedged with pitch-pine wedges, until a chisel could no longer be inserted.

Sinking was again resumed, and the shaft tubbed and wedged in four more stages, as described above (with the exception that the space behind the tubbing was filled with concrete) until the position of the main wedging curb was decided upon.

The sand was found to be frozen a compact mass, and was sunk through as ordinary in strata. A suitable bed for the main curb was found at a depth of 585 ft. from the surface, or 50 ft. below the bottom of the boreholes.

The bed for the curb was carefully dressed and leveled and the first curb laid upon it. This curb was similar to those already described. The space between the back of the curb and the wall sides was closely packed with timber, the grain running vertically. This was wedged with pitch-pine wedges until a chisel could not be made to enter.

The shaft sides were next shorn back to admit the main curb, which was 10½ in. deep by 2 ft. 3 in. in width, 16 segments forming the circle of the shaft. The metal was 2½ in. thick with suitable strengthening ribs. Yellow pine sheeting was laid upon the curb already laid, and the main curb placed upon it. Timber as before was packed between the back of the curb and the wall sides, then carefully wedged, and the tubbing was then inserted in the ordinary way. The time occupied in sinking, walling, and tubbing this portion of the shaft was 6⅓ months.

The total depth of tubbing is 516 ft., the thickness of metal varying from ⅞ in. at the top to 2⅛ at the bottom. The thickness increases ⅛ in. every 20 rings. Special rings for carrying buntons for supporting rising mains, etc., are fixed in suitable positions. The total weight of tubbing is 1,880 tons.

The thawing of the ice wall was commenced by Messrs. The Franco Belge Company on April 1, 1927. This consisted of circulating brine warmed by steam through the freezing tubes. A contract for the remainder of the sinking below the frozen ground has been entered into with Mr. H. Woodfield, of Messrs. Howard & Woodfield, and sinking resumed March 1, 1927. The depth of the completed shaft is now (May 16) 960 ft.

The rate of progress below the frozen ground, including the insertion of 9 in. brick walling, averages 8½ ft. per diem. The thawing is practically completed, and the theoretical pressure of water due to the static head is now registered upon the gauge fixed in the tubbing. The sinking was delayed six months owing to the strike.

The Vane shaft is now frozen, and all necessary erections completed for the sinking which will commence on May 17.

The headgears, which have been erected by Messrs. Head Wrightson & Co., are of the lattice girder type. The height from the surface to the center of the pulley wheels is 80 ft. The permanent pulleys will be 18 ft. in diameter.

The winding engine at the Tempest pit is temporary. It consists of two cylinders 26 in. in diameter, with 5 ft. stroke. The drum is cylindrical, and 10 ft. in diameter.

The winding engine at the Vane pit is permanent, and erected by Messrs. Robey & Co., of Lincoln. It consists of a pair of 32-in. cylinders, with 72-in. stroke. The drum is temporary, 14 ft. in diameter. The permanent drum will be semi-conical, with diameters varying between 14 ft. and 21 ft.

The crab engines are built by Messrs. Worsley Mesnes, of Wigan, each having two heavy cast-iron drums 3 ft. 6 in. in diameter, with worm gearing and two cylinders 11 in. in diameter by 10-in. stroke.

The boilers at present consist of four Woodeson patent water tube boilers, each capable of evaporating 20,000 lbs. of water per hour. (*Continued on page* 831)

CENTRIFUGAL VS. PLUNGER PUMPS FOR DEWATERING MINES

Centrifugal Pumps Satisfactory For Permanent Pumping Stations Where Unit Capacity Is 500 G. P. M., Total Head Over 200 Ft. And Power Constant—Plunger Type Gives Best Results Where Location Not Permanent And Power And Supervision Irregular

By E. R. KENDALL*

IN ANY discussion of the relative merits of Centrifugal vs. Plunger Pumps for mine service, it must be borne in mind that each type has many advantages for certain work and conditions. There are many factors that affect the successful operation of each type, one of the main ones being whether or not the men who look after the pumping equipment are favorable to the type installed.

In choosing the type of pumps for mine service it is necessary to consider the following conditions:

1. The period of time the equipment will operate under original conditions.
2. Capacity in g. p. m. and dynamic head.
3. Suction conditions and size of sump.
4. Acidity of water to be pumped.
5. Power conditions.
6. First cost, operating, installation and repair costs.
7. Amount and kind of supervision the pump will receive.
8. Life of both types.

In considering the foregoing there are many local conditions that would affect a choice of equipment, but taking up each item as numbered we find that:

1. The centrifugal is not considered where the location is temporary, as it can not be used on variable heads, while the plunger pump can be used on any head up to the limit of pressure for which it was designed.

2. As a general rule, the plunger pump is used up to capacities of 500 g. p. m. and 200-ft. head, and centrifugals for larger capacities and heads. This is due mainly to the higher efficiencies of the plunger pumps over the centrifugal, especially in smaller sizes.

3. If the sump is large in proportion to the capacity of the pump, if the suction line will be short and installed without air pockets, and if the unit will have frequent inspections, the centrifugal can be used, for it is characteristic of this type of pump that it will not handle air. The plunger pump, if properly installed, will handle large quantities of air, will work on long suction lines, and does not require as close supervision as the centrifugal. There is now on the market reliable automatic control for centrifugal pumps that does away with the close supervision formerly required.

4. The kind of water to be handled is one of the most important questions entering into the choice of a pump. If the water contains acid to an extent that special metal must be used in the construction of the pump, the first cost will be in favor of the centrifugal, as the parts coming in contact with the water for a given size pump will be smaller than on a plunger pump.

5. The power for operating centrifugals should be fairly constant, as low voltage may mean a reduction in speed that would seriously affect the performance of the unit. Slower speed on a plunger pump reduces the amount of water discharged in proportion and the static head remains the same, but with the centrifugal type the static head produced is dependent upon the centrifugal force developed by the impeller. Low voltage is not often a factor in large pump stations, where the power lines are taken directly to the pumps, but it is a large factor where the pump motors are run from the trolley or from any other line that has a fluctuating load.

6. The first cost of the centrifugal pump only is usually lower, but as they require larger motors than a plunger pump of the same capacity and head the total cost of the unit, including motor, is near the price of the plunger pump and motor. Where the automatic control equipment is installed, the total cost will usually exceed that for the plunger pump installation.

The operating cost of the centrifugal will be higher, due to its lower mechanical efficiency, and this amount will vary according to the size of equipment and efficiency that can be secured in both types and also the rate paid for power.

For a given size unit complete, with motor on a common sub-base, the installation cost of the plunger pump should be about the same as for a centrifugal. However, the plunger pump will require more head room, and for pumping stations inside the mine this will, in some cases, increase the installation cost 10 percent or more.

The repair cost of the centrifugal should be less than the plunger pump, providing it has the proper supervision. However, it is a high-speed unit compared with the average plunger pump, and, if not properly taken care of, the repair expense, including labor cost for replacement, etc., may run higher than for a similar plunger pump installation.

7. As explained in item No. 3, the centrifugal must have much more supervision than the plunger pump, unless expensive automatic control is installed, and it should be by experienced mechanics familiar with the equipment.

8. It is impossible to give any reliable data on the comparative life of pumps, as there are so many factors that affect the life of different units, although the operating conditions may be the same. There are plunger pumps in use that have been in almost constant service for over 25 years, and where the water was not acid these pumps have never had any replacement of parts except valve equipment. If the water is acid, it is very hard to estimate the life of any castings that come in contact with the water, as this will depend on how nearly perfect the casting happens to be, how much the total acidity of the water will vary from time to time, and, as pointed out later in the case of plunger pumps, how close the attendant will watch the unit and stop any by-passing in the valve chamber. With the proper attendance the life of the centrifugal should be as long as the plunger pump, but when major parts are purchased for the centrifugal the cost of these parts will represent a greater percentage of the cost of a new pump than would be the case with the plunger type. This fact is in favor of choosing the plunger pump, especially where the water conditions are very bad and total head 200 ft. or less.

Summing up the foregoing in a general way, we find that for permanent pumping stations, where the unit capacity is 500 g. p. m. or more, the total head over 200 ft., the power constant and where the pumps will have close supervision, the centrifugal type should be selected.

Where the location is not permanent, the capacity less than 500 g. p. m., the total head less than 200 ft., the power subject to frequent interruptions, and the supervision irregular, the plunger type of pump should give the best results. If the total acidity of the water is so great that chrome iron or other special metal must be used for the parts coming in contact with the water, the problem is not so great for the centrifugal type, but if the plunger pump is to be used the valve chambers and cylinders are very difficult to cast and machine. This is naturally reflected in the first cost of the plunger pump, and such castings should have frequent and careful inspections to see that the water does not by- (*Continued on page* 831)

* The Deming Co., Salem, Ohio.

SAFETY METHODS OF THE GALLUP AMERICAN COAL COMPANY

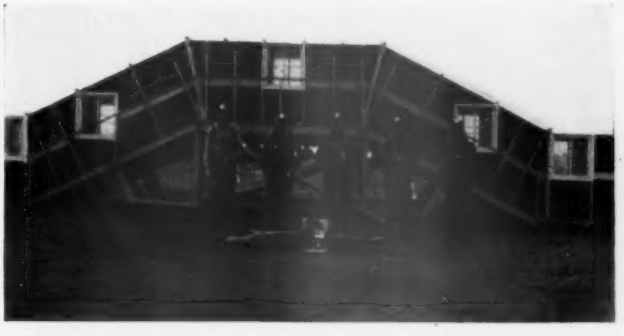
Safety Committees Among Men And Foremen Have Proved Extremely Valuable—Rock Dusting, Explosive Hazard Tests, Mine Safety Station, Ventilation, Reinforced Concrete Shafts, And Proper Precautions In Electric Appliances Some Of Measures Adopted

By L. M. KUHNS*

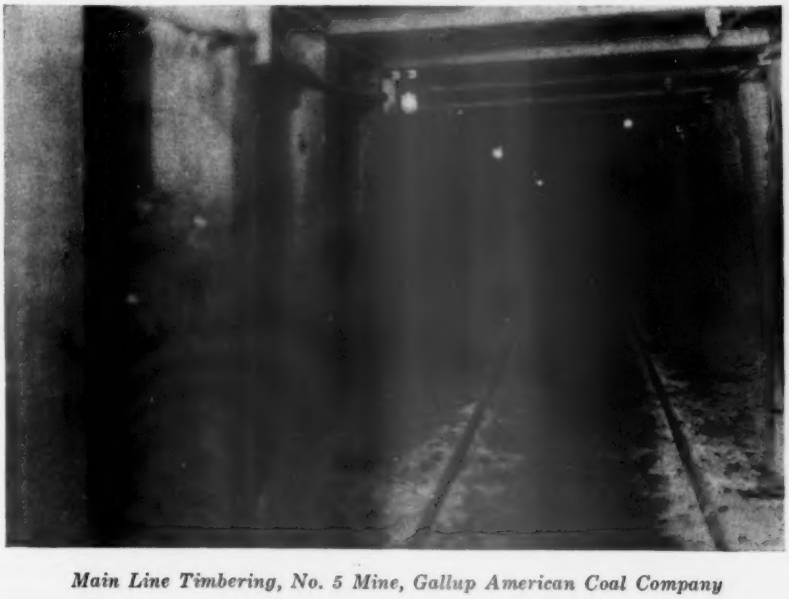
THE No. 5 Mine of the Gallup American Coal Co. is located at Gamerco, about 4 miles north of Gallup, N. Mex., and is the only mine which is being operated at the present time by that company. Although explosive gas has never been detected in the Gallup district, the mine is operated with closed lights, no matches nor smoking are permitted in the mine and every precaution that is generally used in gaseous mines is taken in order that the risk from gas, which is inherent in all coal mines, may be reduced to a minimum. Only type E Edison electric safety lamps are permitted in the mine, with the exception that approved type flame safety lamps are carried by the fire boss, shot firers and safety engineers.

Explosive hazard tests made by engineers of the United States Bureau of Mines have shown that coal dust from the Gallup measures is highly inflammable and at first watering and air humidifying were used to a certain extent to overcome this hazard. This, however, was found to be very expensive and difficult to keep up and did not give the desired degree of safety, so several years ago a rock-dusting machine was purchased and the entire mine thoroughly dusted. This machine is equipped to run either from the trolley wire or the battery of a combination locomotive and is pulled by a locomotive against the air current. The entire operation is performed by two men, who can give a good coating of dust to about 1 mile of entry during an eight-hour shift.

The dust used is gypsum, which is quarried at Laguna, N. Mex., about 100 miles from the mine. Once a year the company sends a man to Laguna, who hires Indian laborers to assist him and quarries and loads into railroad cars a sufficient quantity of gypsum to last throughout the ensuing year. At the mine the gypsum is first put through a jaw crusher and then through a KB hammer pulverizer, which reduces it to an extent that at least 60 percent by weight will pass through a 200-mesh screen and 90 percent through a 100-mesh screen. Analysis at the Bureau of Mines laboratory shows this gypsum to be an excellent dust for this purpose, being 100 percent incombustible and containing less than 6 percent free silicia or quartz.



The 1926 Winning Mine Rescue Team in front of gallery specially built for use in mine rescue training and contests, Gamerco.



Main Line Timbering, No. 5 Mine, Gallup American Coal Company

In air courses where tracks are not available, the dusting is done by means of a nozzle or injector, which was constructed in the shop at the mine. This is attached to a compressed air line, and the dust is blown into the air current. This is done every 500 ft. along the air courses and a very satisfactory coating is given for that distance. No specific amount of dust is applied per foot of entry, but analysis is made by the volumetric method at regular intervals and redusting is done whenever the incombustible content of the dust falls below 70 percent or when the combustible matter forms a noticeable coating over the gypsum. Sampling is done by the vacuum method where electricity is available and in other places by brushing. Usually the main haulage roads require redusting about once a year and the

* Safety Engineer, Gallup American Coal Co.

air courses about once every three years.

Rock-dust barriers of the V-trough type are installed at the mouths of all cross entries and air courses and distributed at various places along the main entries and air courses. These are filled with gypsum dust and inspected regularly to see that they are in good working condition and that the dust has remained dry.

Regular inspections of all working places and available gobs are made each night by a fire boss, who makes a written report of conditions as he finds them, which report must be examined and signed by the mine superintendent and each mine foreman in the morning.

All blasting is done by shot firers at a time when no other persons are allowed to be in the mine and only permissible powder is used. Each shot firer has an assistant who travels with him and who makes tests in all working places for inflammable gas and bad air in addition to helping with loading and tamping the shots. The shots are fired by electric machine, and only the shot firers are permitted to have detonators in their possession in the mine. Powder is taken into the mine by the miners in nonconducting fiber cases which are marked with their check numbers. Upon coming off of shift in the evening, they leave their cases at the magazine with a note stating their requirements for the next day. In the morning they receive their cases, which have already been filled, and receipt for the amount of powder received.

The mine is divided into five districts, each district in charge of a mine foreman, and the entire underground organization is under the supervision of the mine superintendent. Each foreman is required to visit each working place in his district at least twice every shift, and is held personally responsible for the condition of his district.

Timbering is done systematically and props must be set in all working places so that there is, in no instance, more than 5 ft. in any direction from one prop to another or to the rib or face. As the roof in most parts of the mine is very bad, timbering a great deal closer than this is often required, and it is the foreman's duty to see that closer timbering is done where necessary.

Safety committees have been organized among the men and foremen, and have proved their worth many times. The foreman's committee consists of all foremen, both inside and outside of the mine, and the employes' committee of men representing each phase of employment in and around the mine. Each committee meets separately once each month for two months; the third month a joint meeting of the two committees is held, and dinner and some sort of entertainment is provided by the company. At these meetings the men and foremen freely discuss the safety problems which have been encountered, and very good results have been obtained. At all safety committee meetings discussion is confined to safety and no other matters are allowed to be brought up. All suggestions are carefully considered, and when one is found to be impractical the man who made it is told why. One half of the membership of the employes' committee is changed every three months, thus changing the entire membership twice a year.

Fire protection is provided in the mine by fire extinguishers. Two 2½-gallon extinguishers of the foaming type are placed at each parting, and each locomotive and hoist is supplied with a 1-quart carbon tetra-chloride type extinguisher. For protection outside of the mine, the company has purchased a fire truck, and a very active and efficient volunteer fire department has been organized. All structures near the shafts are of fireproof construction, and smoking is not permitted on the tipple nor head frames.

No tools are allowed to be carried on the cages when men are being raised or lowered. On coming off of shift, each man leaves his dull tools with a tool man at the bottom of the shaft and is issued a check for them. They are later sent to the shop in tool cars and, after being sharpened, are returned to the shaft bottom where they are arranged in racks and given to the proper men in the morning.

It is the object of the company to eventually have all employes trained in first aid. This has not as yet been accomplished, but training is carried on regularly and about 50 percent of the men have now completed the course and have been issued certificates. The application of first aid in injury cases has proved to be of great benefit, as a number of lives have been saved and infections and time lost on account of accidents reduced. First-aid cabinets and stretcher outfits are kept on each parting in the mine and are inspected and refilled regularly.

A mine safety station is maintained which is in charge of a safety engineer and an assistant. It is located in a separate building and is equipped with Gibbs oxygen breathing apparatus, Draeger one-half hour apparatus, Burrell all-service gas masks, self-rescuers, mine-rescue telephone, oxygen pump, life line, safety lamps and other equipment, and supplies needed for recovery work and mine fire fighting. The station is also equipped with gas and dust analysis apparatus and an emergency first-aid dressing room. Training in the use of the rescue apparatus is carried on constantly, and at least three teams of highly trained men are at all times available. Once a year a field meet is held and suitable prizes given for contests in first aid and mine rescue and for other events, such as timbering, rope splicing and coal loading. A gallery has been constructed in which men doing mine rescue work can be kept under observation while in an irrespirable atmosphere both during training and contests.

As each man enters the mine, he is given a check on which his pay-roll number is stamped, and on coming off shift this check is returned to the check cabin and hung in its proper place on the check board. A card under each check shows the man's name, number, place of residence and working place in the mine. This check board must be entirely filled before the shot firers are allowed to enter the mine, and, in case a check is missing, the man must be located before any shots are fired. This board is also very useful in case that it is necessary to locate a man either in the mine or at his home. Each man's lamp is also stamped with his number, which gives an additional check on the men in the mine. Any outsider or visitor entering the mine must sign a card releasing the company from any liability in case of accident, and his or her lamp number is noted in a book kept in the lamp house for that purpose.

Ventilation is watched very closely and measurements made at frequent intervals. The fan is a 6 by 12-ft. Connellsville reversible running as a blower and delivers 140,000 cu. ft. of air per minute against a 3-in. water gauge. It is equipped with explosion doors and thermostatic control and is driven by a 285-hp. electric motor. A steam engine is located in the fan house and, by simply throwing in a clutch and throwing off the motor belt, the fan can be transferred to this engine. An auxiliary fan has also been installed which can be started instantly in case of a complete failure of the regular fan. It is a double Sorocco 54-in. fan and capable of delivering 60,000 cu. ft. of air per minute.

It was found that during the winter months ice would form in the air compartment of the shaft and very seriously interfere with ventilation. Steam air tempering coils were installed in the fan intake and the air now going into the mine can be kept above freezing temperature at all times. All overcasts are of concrete and steel, and all main line stoppings are of concrete.

Miners are required to wear goggles while working at the face, and goggles are supplied to all other men working where an eye injury hazard is present.

When open lights were discarded and electric cap lamps introduced, the socket then in use on underground haulage ropes was changed from the ordinary babbit type to a wedge socket that requires no

heat to attach and which has proved safer and more efficient than the older type.

Both shafts are lined with reinforced concrete from top to bottom, and a 9-in. concrete wall separates the air compartment of the air shaft from the hoisting compartment. A steel stairway with hand railings is installed in the main shaft to provide an escapeway in case of failure of the hoisting equipment, and it is divided from the hoisting compartment by heavy wire gratings. Rock and refuse from the mine are brought out through the man shaft, and it is equipped with cages of the overturning type. Hoisting men is not permitted unless the cages have been balanced at the surface landing and hoisting ropes inspected daily.

Safety bulletins are posted in and around the mine in various places, and flashing electric signs, carrying warnings, are installed on each side of the bottom of the man shaft. The glass sides of these signs are changeable and the wording is altered from time to time.

An effort is being made at the present time to induce the men to wear safe clothing and such articles as hard-boiled caps, safety shoes and battery pouches have been put on sale at the store. It is too early yet to judge as to the results which may be obtained through the use of these articles.

Complete reports and statistics are made and kept on all accidents and they are discussed at the meetings of the safety committees and an effort is made to find ways and means of avoiding similar accidents in the future.

Trips are handled in the mine by a dispatcher and are controlled by an electric block system. All motor trips carry red tail lights and all trips going up grade carry drags. Cars are blocked in raise and dip workings by special rail clamps, designed and made at the mine, and one-piece cast-steel frogs are used throughout the mine.

Every three months a cash bonus is given to the foreman having the best accident record, and a smaller bonus to the next best. The scores are figured on a basis of total shifts worked during the period per day lost on account of injury. The foreman who received the bonus for the second quarter of 1927 had a record of 500 full-time shifts worked for each day lost from accident in his district. This applies only to underground foremen, but any foreman in the employ of the company, either inside or outside of the mine, is given a bonus if, in his department, there are no lost-time accidents during any one three-month period. During the second quarter of 1927 three such bonuses were earned.

One section of the mine has been set aside as a place of instruction for newly employed men. When a miner is hired he is given a place in this section, which is in charge of a special foreman or instructor, and works there until the foreman is convinced that he is competent and able to take care of himself.

While the number of accidents is gradually being reduced, results obtained to date have been far from satisfactory, and it is hoped that by maintaining the strictest discipline and enforcing all safety rules a marked improvement will be shown this year. Since the introduction of the bonus system the foremen realize the necessity of making better records in safety, and it is very evident that more interest is being manifested and the entire personnel throughout the mine is making a sincere effort to reduce the number of accidents to a minimum.

LONDONDERRY COLLIERY

(*Continued from page* 827)

The stokers are supplied by the Underfeed Stoker Co., and are of the forced draught type.

Two of the boilers are fitted with Woodeson's patent superheaters, and a Green's Economiser has been placed in the main flue leading to the chimney.

The chimney is 200 ft. in height by 10 ft. in diameter.

The boiler plant is laid out so that another economizer may be added, as also induced draught, if necessary.

The water softener is of the "Becco" type, capable of treating 8,000 gallons of water per hour; the hardness of the water is thus reduced from 22 degrees to 4 degrees.

Ventilation in the sinkings is produced by two "Sirocco" fans, having a capacity of 15,000 cu. ft. per minute, at a water gauge of 10 in. They are electrically driven by 25-hp. motors, each pit having a separate unit, the air tubes being of steel 24 in. in diameter.

The power station is at present erected of sufficient size to house one of the permanent fan engines, and a generating set of 1,000 k.w., by Messrs. Metropolitan Vickers. The turbine is of the high-pressure type, taking steam at 140 lbs. per square inch at the stop valve. Speed 2,400 r. p. m. Alternator direct coupled 2,750 volts, 3 phase, 40 periods, cooled by inclosed ventilated system. Multiple jet condensing plant with motor-driven air and extraction pumps. The switchboard is of the drawout truck type.

The house will afterwards be extended to contain a duplicate fan engine, two air compressors, and probably two exhaust steam-driven turbines.

The power station is linked up with the station at Seaham Colliery, and will subsequently be also linked with the plant at Dawdon Colliery.

A cooling tower has been erected of the Premier Cooling and Engineering Co.'s type, capable of cooling 230,000 gallons per hour from 100° Fahr. to 80° Fahr. Height of tower, 70 ft.

A railway connection has been made with the L. & N. E. R. near to Hall Dene. By this means practically all the material required for the new sinkings is being delivered.

A railway will shortly be constructed on the south side of the new winnings to connect them with the Seaham Harbor docks, at which the shipment of the coal will be effected.

CENTRIFUGAL VS. PLUNGER PUMPS

(*Continued from page* 828)

pass around the valve seats, as the casting will soon be ruined beyond repair if this condition continues for even a day or two in extreme cases.

One exception to the above summary of conditions would be where the capacity is small and the head high, say, 500 g. p. m. or less against a head of 200 ft. or more, and for this condition the plunger type should be selected on account of its higher efficiency.

Providing the proper type of pump is selected for the job and properly installed, the successful operation of either type will be in direct ratio to the amount of intelligent attention given it, and in this connection the following is quoted from the recently issued "*Mine Drainage Standards*," as approved by the American Engineering Standards Committee, sponsored by The American Mining Congress:

> "We recommend: Definite fixing of responsibility for the operation, care, and inspection of each piece of pumping machinery in such a manner that same will be insured proper attendance at regular intervals, and will not be forced to rely on haphazard attention delegated to whoever happens to be in the vicinity at convenient times.
>
> "More careful selection of pump attendants and believe that more stress should be laid upon a man's fitness for the job, and that the operating of mine pumps should not be regarded as a system of pensioning men unfit for more useful work, as is often the case at present."

There is no machinery in a mine more important to its operation than the pumping equipment, and yet outside of certain large pumping stations the pumps are frequently looked after by men who are not capable of giving them the attention they require. This is a condition that must be changed if pumping costs are to be kept in proper relation to amount of water handled, and is equally important as selecting the type of pump to do the work.

In the foregoing, pumps for gathering service only have not been considered, as they are usually of the packed piston type and ranging in capacity from 25 to 100 g. p. m. against maximum heads of 100 to 200 ft., mostly friction.

CONCERNING PERMISSIBLE EXPLOSIVES

In Which The Author Explains Two Frequent Questions: What Is A Permissible Explosive? And Why Do Permissibles Sometimes Burn In The Hole Or Fail To Detonate, And How Can This Be Prevented?

By PAUL F. LEWIS *

"WHAT is a permissible explosive?" This is a question frequently asked which is best answered by quoting briefly from Schedule 17-A issued by the Department of Commerce, Bureau of Mines, April 1, 1926, which states as follows:

> "A permissible explosive is an explosive which is similar in all respects to the sample which has passed certain tests prescribed by the Bureau of Mines to determine its safety for use in coal mines, and when used in accordance with the conditions prescribed by the bureau."

The conditions prescribed by the bureau are as follows:

> "I. That the explosive is in all respects similar to the sample submitted by the manufacturer for test.
>
> "II. That electric detonators are used of not less efficiency than those prescribed, namely, those consisting by weight of 80 parts of mercury fulminate and 20 parts of potassium chlorate (or their equivalents).
>
> "III. That the explosive, if frozen, shall be thoroughly thawed in a safe and suitable manner before use.
>
> "IV. That the quantity used for a shot does not exceed 1½ pounds (680 grams) and that it is properly confined with clay or other non-combustible stemming.
>
> "After an explosive has passed the required tests and its brand name has been published in a list of permissible explosives, it is not used in a permissible manner if one or more of the following conditions prevail:
>
> "1. If stored under improper conditions until it undergoes a change in character.
>
> "2. If used in a frozen or partly frozen condition.
>
> "3. If used in excess of 1½ pounds (680 grams) per shot.
>
> "4. If the diameter of the cartridge is less than that designated in the column 'Smallest permissible diameter.'
>
> "5. If fired with an electric detonator of less efficiency than that prescribed.
>
> "6. If fired with fuse.
>
> "7. If fired without stemming.
>
> "8. If fired with combustible stemming.
>
> "9. If fired in the presence of a dangerous percentage of fire damp.
>
> "10. If the shot is a depending shot or is bored into the solid or has a burden so heavy that the shot obviously is liable to blow out."

IMPORTANCE OF GIVING THOUGHT TO CHARACTERISTICS AND PROPER USE OF PERMISSIBLES

As the use of permissible explosives is increasing daily in the coal mines of the country and as explosives of this type in the hands of miners inexperienced in their proper handling, storage and use give rise to frequent complaints of incomplete detonation, burning in bore holes, soft cartridges, hard cartridges, and the like, it might be well for coal mine operators and others employing permissibles to give some thought to this very important subject, especially in view of the fact that nine out of every ten such complaints investigated by the writer in a field where permissible explosives are used extensively are found to be caused primarily by improper storage and improper use, due to a great extent to a lack of understanding of the physical nature of these explosives and of the fundamentals of their proper use.

COMPOSITION AND PHYSICAL CHARACTERISTICS OF PERMISSIBLES

The majority of the permissible explosives of today are of the ammonium nitrate type, that is, the principal explosive ingredient is ammonium nitrate, a crystalline substance somewhat resembling table salt in appearance and having a similar affinity for moisture, for like table salt it is hygroscopic, absorbing moisture from the atmosphere.

In the manufacturing processes the ammonium nitrate is mixed with sodium nitrate and other chemicals, wood pulp and other carbonaceous materials to give the finished explosive the desired oxygen balance, low flame temperature and bulk, and to this mixture is added a small quantity of nitroglycerin to make it properly sensitive. The several ingredients are thoroughly mixed in charges of approximately 600 pounds. The mixture is then mechanically tamped to a uniform density into paraffined paper shells and the finished cartridges are dipped into melted paraffin to seal them against moisture.

All ingredients used are thoroughly dried before being mixed so that analyses from representative quantities show moisture content of less than one-half of 1 percent. The finished product must show less than 1 percent of moisture to pass inspection before being shipped to the distributing magazines or to the consumer.

Properly made permissible explosives can reasonably be expected to stand storage in a dry, well-ventilated magazine for as much as six months, but when stored in a damp atmosphere or in a poorly ventilated magazine where

* Representative, E. I. du Pont de Nemours & Co., Inc. Reprinted from Explosives Service Bulletin, July, 1927.

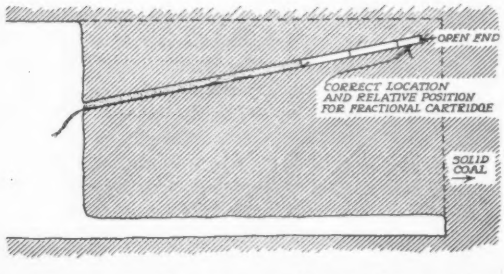


Fig. 1—Load a part cartridge in this position

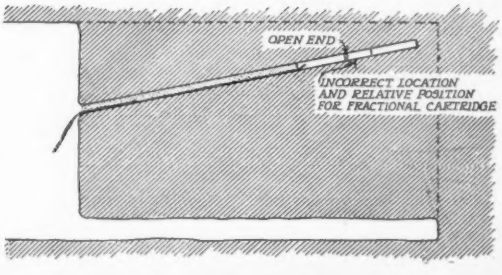


Fig. 2—Do not load in this position

extremes of temperature cause condensation of the moisture in the atmosphere, ammonium nitrate base explosives have been known to deteriorate in from one to two weeks so as to be too insensitive for safe use.

The primary effect of moisture on ammonium nitrate base explosives in the incipient stage often takes the form of "setting"; that is, the cartridges become hard. In cold weather explosives which have set are often erroneously called frozen. What really happens is that the ammonium nitrate crystals, when subjected to moisture, break down or liquefy, giving up some of their liquor to be absorbed by the spongy carbonaceous materials, such as wood pulp, and then recrystallizing, thus bonding all the materials together. When in this condition, the explosive does not detonate as readily as before.

The final effect of moisture on the ammonium nitrate is completely to break down or dissolve the crystals. The liquor saturates the absorbent fibrous material so that the contents of cartridges become wet, soggy and discolored, and absolutely insensitive to detonation. The conclusion is obvious. To prevent trouble with ammonia permissibles it is essential to keep them from being exposed to moisture.

Storage Outside the Mine

A dry atmosphere and uniform temperature should be the objective when building a magazine in which to store explosives of any kind. This can be best attained by building so that the floor is well off the ground and by providing screened ports of ample size to assure a good circulation of air above and beneath the floor. For a fuller description of proper magazine construction see the Du Pont Explosives Service Bulletin entitled "Storage of High Explosives," by C. H. Coale. This bulletin, as well as detailed plans and specifications for magazines, can be obtained by applying to the Du Pont Company, Wilmington, Del., or to the nearest branch office of the company.

Storage Inside the Mine

Permissible explosives should not be stored inside the mine. As the atmosphere in the driest of mines contains a high percentage of moisture, especially during summer months, it is advisable never to take into a mine more than one day's supply of explosives, and in cases where some explosive is left over from the day's shooting, it should be brought outside and properly stored until needed for shooting.

Permissible explosives left in the mine over night often shows beads of moisture on the paraffined wrappers and broken cartridges are likely to have absorbed enough moisture at the open end so as to be unfit for use except when loaded as illustrated in Figure 1.

Proper Use of Permissible Explosives to Assure Complete Detonation

Permissible explosives should be taken into the mine in a container designed to keep the powder dry. Powder left over from a previous day should be used first.

Half cartridges or other fractional parts of cartridges should always be so placed in the bore hole that the open end, which may have become insensitive through the absorption of moisture, will be next to the solid coal and thus will not prevent propagation of detonation through the rest of the charge. The improper location of part cartridges is, in my experience, the greatest single factor contributing to either incomplete detonation or burning of a charge.

Before loading a bore hole particular care should be taken to see that the hole is scraped free of dust or borings. It is also advisable to make it a practice to push the entire charge to the back of the hole at one time in order to avoid getting borings between cartridges, something which is apt to occur and often does occur when each stick is pushed back separately. Even a small quantity of dust is sufficient to form an obstruction which will prevent propagation. In some tests that were made along this line one-half inch of coal dust between two cartridges caused the unprimed cartridge to fail in 50 percent of the test shots. One inch of coal dust between the two cartridges caused failure of 100 percent of the test shots. This surely proves the desirability of scraping the hole and pushing the cartridges all back together.

Some missed shots have been traced to the practice on the part of miners and shot-firers of cutting the paper off the ends of cartridges and of rolling cartridges to make them soft, in the belief that by so doing they make the explosive more sensitive. Rolling is bad practice when applied to a normal cartridge for two reasons. In the first place, the powder is carefully packed at the plant to the density calculated to give best results. In the second place, in rolling the cartridge the crimped ends are opened and the powder is exposed.

If cartridges with open ends are placed in a wet hole—and many mines have some wet holes—the powder is directly exposed to the water which backs up around the charge when the hole is tamped. The water, having free access, quickly enters the powder at the ends and desensitizes it. An inch or two of insensitive powder at the cartridge ends may easily stop propagation of the detonation.

Another cause of incomplete detonation is the use of electric detonators of such poor water resistance that if exposed to moisture for any length of time they become weakened to a point where their force when exploded is below that set for a standard No. 6 detonator. As a result, the wave of detonation started by the explosion of the detonator dies out in what is termed a local or partial detonation, having exploded only the powder immediately adjacent to the detonator.

One of the important steps in the development of present-day industrial explosives has been making them safer to use than were the earlier types by decreasing their sensitiveness to ordinary shocks of handling and transportation. Consequently a powerful concussion is necessary to detonate them properly in the bore hole. Especially with the increasing use of low-density explosives in small diameter cartridges is it important that detonators be used which can be depended upon at all times to give an initial shock as strong as that produced by a standard No. 6 detonator.

A Few Pertinent Don'ts

Don't store explosives or accessories in a damp or poorly ventilated place.

Don't take into the mine more than one day's supply of explosives.

Don't cut ends off cartridges or roll them.

Don't put broken cartridges between two or more whole cartridges when loading a hole. (See Figures 1 and 2.)

Don't purchase detonators until you have looked into their water-resisting qualities.

Don't blame explosives for failure until certain that they are being properly stored and used.

INTERNATIONAL FUEL CONFERENCE

Announcement has been made by the International Executive Council of the World Power Conference of an International Fuel Conference at the Imperial Institute, London, England, September 24-October 6, 1928. The classes of the technical program are: (1) Solid Fuel; (2) Liquid Fuel; (3) Gaseous Fuel; (4) Fuel Utilization—General, and (5) General Aspects. The general program is divided as follows:

Division 1. Composition and classification of fuels.

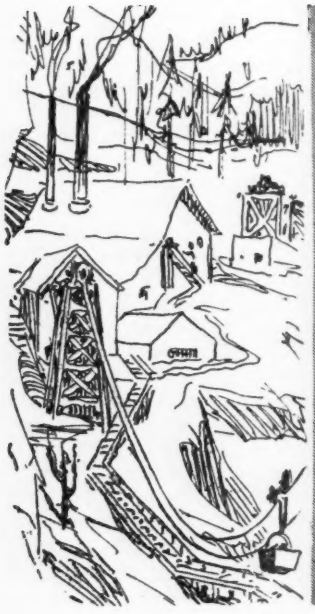
Division 2. Preparation of fuels.

Division 3. Storage, handling and transmission of fuels.

Division 4. Utilization of fuels.

There will also be discussed the training of fuel technicians, a survey of the scope of organizations concerned with the efficient use of fuel in industry and the economic possibilities in the better coordination of fuel utilization.

Represented in the World Power Conference are 47 different countries.



METALS

PRACTICAL OPERATING MEN'S DEPARTMENT

GUY N. BJORGE, Editor

Practical Operating Problems of the Metal Mining Industry

SLIME FILLING FOR EXTINGUISHING MINE FIRES*

Dry Timber Can Be Ignited By Caved Ground Pressure—Frequent T's Placed In Slime Lines For Flushing—Friction Lessened By 4-Ft. Bends—Dewatered Tailings Consisted Of 31 Percent Solids—Principal Problem Is To Avoid Escape Of Slimes

By HAROLD S. DUNCAN† and A. H. SHOEMAKER‡

ON JUNE 25, 1926, fire broke out in a top slice stope in Block 39, two floors above the 1,800 level. This section of the mine is a distinct vein deposit with well defined foot and hanging walls. The vein dips at about 70 degrees and has an average width of about 35 ft. The fire eventually extended horizontally about 900 ft. and vertically about 400 ft.

The origin of the fire is not known. It is certain, however, that it was not incendiary, for it started above the working floor too far for anyone to have set it. Probably it was due to heat developed by friction. The pressure developed by caved ground could ignite perfectly dry timber.

In the first stages of the fire, an attempt was made to shoot down the mat, to give access so that it could be extinguished with water. The fire was too far overhead and the resulting smoke from the application made it impossible to direct operations.

Bulkheads were then put in to shut off drafts and a crosscut was driven to the fire area on the 1,700 level. From that crosscut a raise was put up and an intermediate crosscut driven from that raise. Water was introduced at the intermediate level, but with no success. The rock temperatures were sufficient to cause re-ignition a short time after apparent extinguishing of the fire.

It was then decided to slime the fire area.

PRELIMINARY WORK

Surface Installation

Installations were made for conveying the tailings from the flotation machines in the mill, by gravity flow, through a pipe and launder to a circular concrete tank (40 ft. in diameter by 10 ft. high), thence through a 3-in. pipe to an open wooden box, thence through a 6-in. pipe to a 3-in. Wilfley pump, type B. The wooden box was placed between the settling tank and the pump to provide a convenient place for obtaining samples. The Wilfley pump discharged through a short section of 3-in. pipe into the main slime line which was 4-in. standard iron pipe, coupled at the joints. The main 4-in. slime line led from the pump to the collar of "C" shaft, a horizontal distance of 450 ft. and a vertical lift of 30 ft.

Underground Installation

The main slime line was then carried down "C" shaft to the 1,200 level (827 ft.), thence east along the 1,200 level to the pump shaft (1,000 ft.), thence down the pump shaft to the 1,600 level (400 ft.), thence east on the 1,600 level to the "K" shaft (3,310 ft.), thence down the "K" shaft to the 1,800 level (200 ft.), thence north and east along the 1,800 level to block 40 (800 ft.)

The main 4-in. slime line was cross connected by a 2-in. pipe to a 12-in. water line at the pump shaft on the 1,600 level, thereby making provision for converting the slime line into a water line should it become advisable.

Branches from the main line were laid to the fire area on the 1,400, 1,600, 1,700 and 1,800 levels. The 1,400 level was reached by running a line up a manway from the 1,600 level and the 1,700 level was reached directly from the main line in the "K" shaft. Three-inch pipe was used principally in the branch lines but this was reduced to 2-in. pipe in some cases for short distances.

Control valves were installed on all lines at proper places, all valves being gate valves. Frequent tees were placed along all slime lines so that flushing with a water hose could be done in case of stoppage. Very little trouble of this kind was experienced as care was always taken to run clear water through the line before and after a slime run; also to see that all of the principal control valves were open at the start of a run.

All 90 degree turns were made by bending a 4-ft. piece of pipe rather than by using regular fittings, thereby reducing the friction at these points.

All slime lines were raised to the top of the drift when entering bulkheads in order to give the best possible initial flow of slimes beyond the bulkhead.

Drift Preparation

Numerous bulkheads were placed underground in the vicinity of the fire area. These bulkheads averaged about 10 in. in thickness and a 1-3-4 mix was used in their construction. All bulkheads were gunited after the forms were removed. Considerable guniting was done to seal cracks in the drifts and in several cases it was necessary to pour a concrete slab over small areas.

METHOD OF FILLING

Description of Area to be Filled

The area involved in the sliming program extended from Blocks 36-44, 1,800 level to the 1,400 level. (See also introduction.) In this particular area there is a continuous stoping from the 1,800 level to the 1,000 level. Had the fire travelled later- (*Continued on page* 855)

* Old Dominion Company, Globe, Ariz. Presented before meeting of Arizona Chapter, American Mining Congress, Globe, Ariz., Oct. 10-11, 1927.

† Chief Mine Engineer; and ‡ Chief Geologist, Old Dominion Co., Globe, Arizona.

Main Live Oak Headframe and Hoist House, Inspiration Consolidated Copper Company

HISTORY OF THE DEVELOPMENT OF THE UNDERCUT CAVING METHOD OF MINING*

Undercut Caving Method Evolved Since 1906—Even Distribution Of Chutes Essential—Stoped Area Arches Inward Toward Center Of Stope—Slicing Assures Ore Caving To A Vertical Line—Final Combination Of Slice Drifts And Small Shrinkage Slices Adopted

By FELIX MCDONALD † & J. L. JOHNSON ‡

IN VIEW of the fact that a large percentage of the total copper produced in the mining districts of Arizona is now being recovered from mines using the undercut caving method of mining, or a modification of it, a brief history of its origin and development might be of interest to mining men.

Block caving into incline chutes was started at the Ohio Copper Mine, Bingham, Utah, in the year 1906. The idea was conceived from the sublevel caving used previously in other mines, and from the chute caving method used at the Utah Copper Mine. The first method mentioned above gave good results as to recovery of ore, with the use of a minimum amount of timber, but a large percentage of the ore had to be shoveled into the chutes, thereby increasing labor cost to a prohibitive point for low grade mines such as are being worked today. The second method was convenient and probably served its purpose very well. It was used to provide ore for the test mill and for weakening the ore body and capping in readiness for steam shovel operations which were planned to follow. As an underground mining method it could not be considered efficient or economical, as there was little control of the ore, and raises were spaced too far apart. If operations had been continued along these lines, the result undoubtedly would have been much loss of ore due to dilution. However, there is no doubt but that the results were satisfactory as far as it was used.

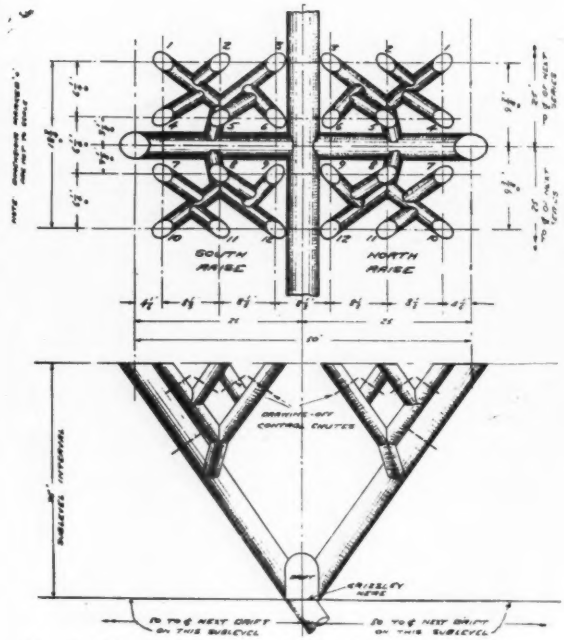
With this in mind, the men in charge of the Ohio Copper Mine saw no reason why large blocks of homogeneous ore could not be caved and good results obtained, providing that the ore was properly undercut, chutes evenly distributed, and the ore drawing well controlled under proper supervision. So they decided to develop a block 100 ft. by 100 ft. The first block had a vertical height or thickness of 30 ft. This was soon changed to 60 ft. The thicker block made possible a lower development cost and a smaller percentage of dilution from waste rock entering the next block below at a point where chutes were located just under the undercut level. It was this dilution which caused the control chutes to be placed as close as possible to the undercut level so that waste rock could not penetrate as far into the succeeding blocks.

It might be stated that higher blocks were not attempted at the Ohio Mine, as there were two high grade stopes that had been previously mined and filled with waste. These stopes extended along each side of the ore body then being mined. It was feared that waste from these dry, narrow stopes might break into partially caved areas of the near-by blocks, thereby diluting the ore to such a degree as to make results unsatisfactory.

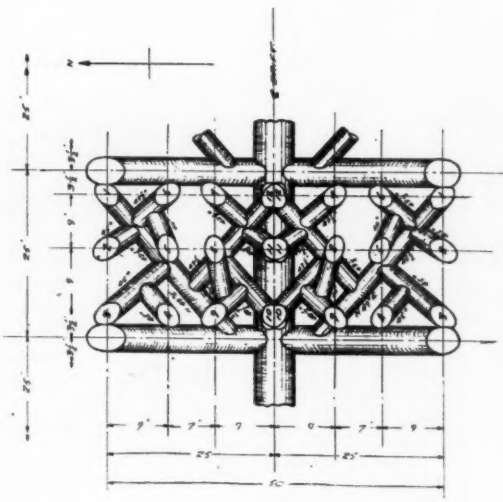
In the year 1911, the Inspiration Consolidated Copper Company started development of a comparatively low grade ore body, following the same method as was then being used by the Ohio Copper Company. After a careful study of local conditions had been made, it was decided to lay out the haulage drifts 100 ft. apart. For some time before actual development for this system of mining was started, drifts and raises were driven to check the results of the churn drill exploration. Applying the unit costs obtained from this work to plans for development of the area to be mined, it was found that placing haulage drifts 100 ft. apart and having the undercutting horizon about 65 ft. above the haulage level gave about as economical development as could be worked out. Drifts a little farther apart were the most economical development, but it was difficult to lay the work out with a space only a little greater than 100 ft. No

* Presented before meeting of Arizona Chapter, American Mining Congress, Globe, Ariz., Oct. 10-11, 1927.

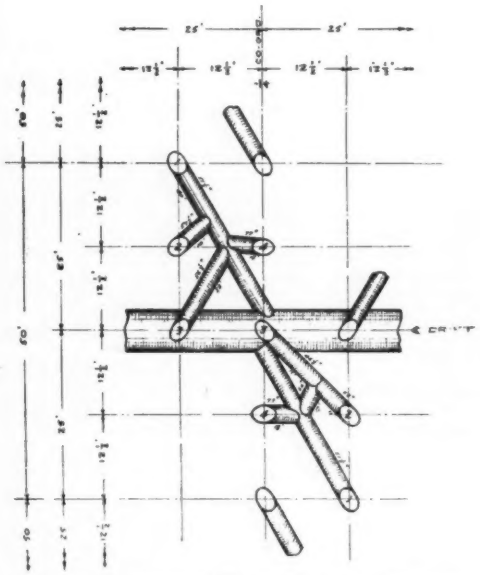
† Mine Superintendent, and ‡ Assistant Mine Superintendent, Inspiration Consolidated Copper Company.



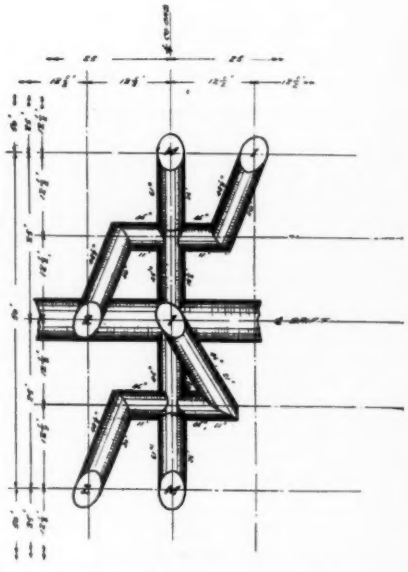
No. 1 Ohio Caving System—Sketch showing necessary raises underneath a 25' by 50' (horizontal dimensions) block of ore. September 5, 1914



No. 2 Caving System. Sketch showing raises immediately under a 25' by 50' (horizontal dimensions) block of ore. May 31, 1915

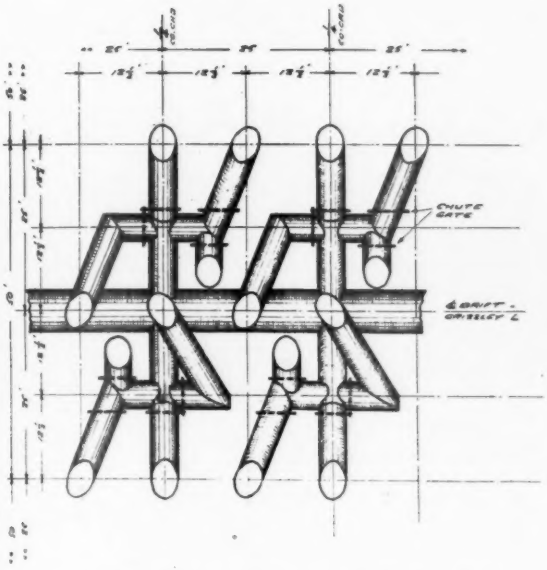


No. 3—Diagram of Finger Raises. January 21, 1916

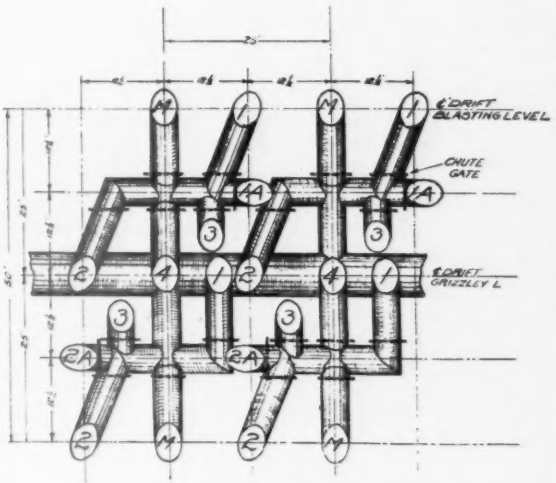


No. 4 Caving System—Diagram of Finger Raises. January 28, 1916

STAGES OF FINGER RAISE DEVELOPMENTS AS TRIED OUT AT INSPIRATION CONSOLIDATED COPPER COMPANY

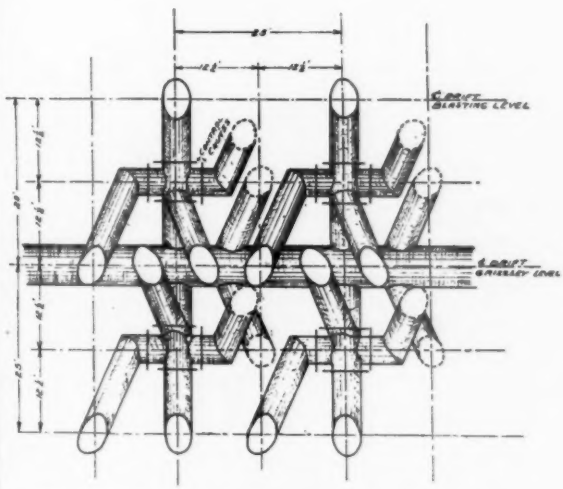


No. 5 Caving System—Diagram of Finger Raises. August 23, 1916

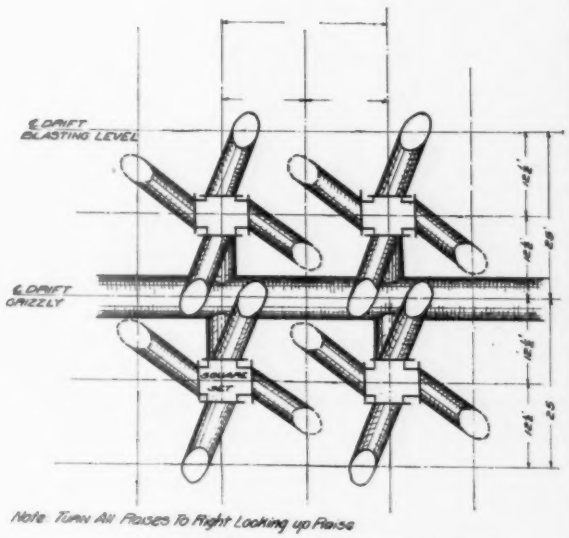


No. 6 Caving System—Diagram of Finger Raises. April 2, 1918

Note—1A and 2A were not part of regular system, but were possible when ground permitted. These later were entirely discontinued.



No. 7 Caving System—Diagram of Finger Raises. May 7, 1919



No. 8—Diagram of Finger Raises

STAGES OF FINGER RAISE DEVELOPMENTS AS TRIED OUT AT INSPIRATION CONSOLIDATED COPPER COMPANY

definite rule can be laid down for this, as it depends on the unit cost of the work and the underground conditions.

The raise interval of 25 ft. was a result of the length of a car, which was, center to center, 8.3 ft. An interval of 25 ft. made it possible to spot a car under a chute and have every third car under a chute at the same time, thus making it possible to load more than one car at a time.

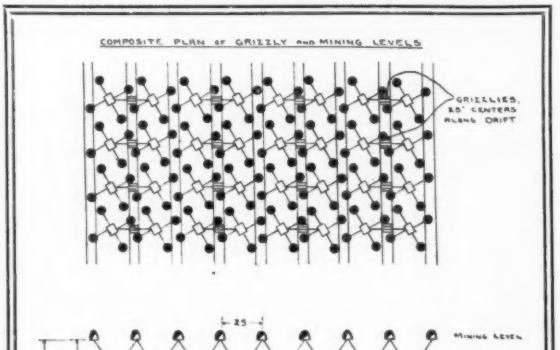
From pony sets over the haulage drifts, spaced 25 ft. apart along the drift, raises were driven at an angle of 54 degrees from the horizontal to an elevation of 30 ft. above the back of the haulage drift. Grizzly drifts were driven along the tops of these raises. These drifts were spaced on 50-ft. centers, so that grizzlies were 25 ft. by 50 ft. apart. Raises were then driven at right angles to the drifts on both sides to a point about 15 ft. above the grizzlies. From this point 12 "fingers," or branch

raises, were driven to an elevation of 30 ft. above the grizzly level. Undercut drifts were run at this elevation parallel to the grizzly drifts on 25-ft. centers. These drifts were later widened and drilled with 10-ft. holes, and the remaining pillars were shot out.

It was found that such close spacing of finger raises (8 1/3 ft.), while desirable, especially in fine, soft ores, was not practicable. Pillars between raises were so small that in ground such as was encountered at the Inspiration Mine raise walls shattered so badly that, in many instances, pillars fell away, leaving no support for control chutes. This idea was abandoned after a thorough trial and fewer finger raises were used. Various methods of placing finger raises were tried with the result that four finger raises from a central square set were adopted. This gave finger raises a spacing of 12½ ft. by 12½ ft. or 156 sq. ft. per raise. Some idea of the number of plans that were used for branch raising can be gained from the illustration. These, in chronological order, show various raise systems that were tried out before it was settled that the four-raise system, with a control square set, was the best from a practical standpoint. These square sets were originally made up to fit the ground, and were located at the intersection of the finger raises, this being about 15 ft. below the undercut level. The first objection to this was that it allowed waste to follow down into the succeeding blocks. This, however, was largely overcome by blocking the ore passes at the grizzly level with timber mats, and increasing the height of blocks, and was entirely overcome when it was decided in 1916 to mine the entire height of the ore body in one block, thus placing control chutes below the ore body.

Early in the work, a standard square set was designed and used for some time. This set was unframed and was rather difficult to block, so a frame set was adopted and is still being used. The old unframed sets were placed in the raises 15 ft. above the grizzlies and parallel with the grizzly drifts. Finger raises were driven at an angle of 90 degrees from the square set. This was changed later to 60 degrees. The reason for this was better spacing of raises on the undercut level and less duplication of draw points.

During this time development, undercutting and drawing were in progression—that is, mining was started at one side of the ore body and continued across it, fairly large, regular sized blocks being undercut at one time. This always left at least one side, and part of the time two sides, of the block being undercut in contact with the waste from the old stopes. The waste angle was kept as near as possible to somewhere between 30 and 60 degrees from the horizontal.



No. 9—Caving System in Use August 24, 1927

At Inspiration it was first thought that in caving a block of ore, the tendency of the outer edges of the block would be to cave outward. The result was that all estimates included ore to an angle of 70 degrees from the horizontal on all boundaries of the ore body. After close observation of the actions of several stopes, the question arose as to the correctness of this theory, and after considerable discussion it was decided to prove whether the ore did actually cave outward, vertically, or inward. At an opportune time, work was started on the driving of raises along the side of old stopes, and at intervals of about 30 ft. (elevation) and 100 ft. apart, drifts were driven into the stoped area to determine the edge of the caved area. It was proved that the stoped area arched inward toward the center of the stope instead of outward, as at first supposed.

At the suggestion of Dr. Ricketts, a slicing method was adopted, which was immediately started around stopes being developed in order to assure ore caving to a vertical line instead of arching inward, as had been found to be the case in previous blocks.

The method of slicing first used was incline raises driven on a 50-degree slope in the section to be sliced, and along the tops of the raises, drifts were driven at intervals of 30 ft., vertically. This was done to within about 30 ft. of the top of the ore body. Pillars between drifts were then shot out, leaving a cut of about 5 ft. in width from the undercut level to within 30 ft. of the top of the ore body. Difficulty in drilling down holes soon led to a change in this method—to a narrow shrinkage stope. However, both of these methods led to trouble, as it was soon discovered that the block of ore cut off in this manner would not slough and crush, as is necessary to successful caving, but settled in a mass. The result was that this block of ore had to be undercut several times before any sloughing could be induced. In the meantime, a great deal of damage was done to the pillar between the undercut level and the grizzly level. This pillar suffered all the crushing effect that should have taken place in the block of ore above the undercut level.

It was clearly demonstrated that some method of retarding the block from settling in a mass would have to be worked out. The result was that a system of combination slice drifts and small shrinkage slices was used. Slice drifts were driven on three sides of the block to be undercut, at vertical intervals of 30 ft., to a point 60 ft. from the top of the ore body. Above this, a 30-ft. shrinkage slice was put in, leaving 30 ft. of ore not cut through. This 30 ft. was left in order to give the center of the stope time to cave before there was any possibility of waste starting down through the slice. In addition to slice drifts, where the ground was hard, backs of drifts were drilled and blasted to further weaken the plane of the cut off. This method of cutting off blocks has proved very satisfactory and is still being used with slight modifications.

As stated above, the accompanying figures, numbered from 1 to 9, illustrate the various stages of finger raise development which have been tried out at Inspiration. No. 9 shows a typical section and plan of the arrangement now in use in the mine.

In conclusion, it should be brought out that the plan of development used suited conditions at Inspiration, and has made for low cost mining. Another mine adopting the undercut caving system of mining would have its own problems as to development and equipment to work out.

The means and methods for mining and drawing of ore, and the ways of controlling the drawing of the ore have been studied. Changes have been made from time to time, and surely it is realized that there remain many improvements to be made which will make this system of mining more profitable, safer, and conducive to the recovery of a larger percentage of the material mined.

Main Live Oak Ore Hoist and Man Cage Hoist

ENGINEERING FEATURES OF THE UNDERCUT CAVING SYSTEM OF MINING AS APPLIED BY THE MIAMI COPPER COMPANY*

Finger Raise System Adopted To Reduce Cost—Churn Drill Sampling Found Correct—Tonnage Allocated To Individual Chutes—Detailed Cost System In Vogue Shows Much Information Of Comparative Value

By A. J. McDERMID †

LATE in 1924 the approach of the exhaustion of the main ore body of the Miami mine necessitated the immediate and speedy development of the low grade ore body, in order to maintain uninterrupted production from the mine. In October, 1925, 10 months from the time that the appropriation for the development of the low grade ore body was made, the production of 6,600 tons of ore per day from the main ore body was replaced by a production of 10,000 tons of ore per day from the low grade ore body, and this has since been increased to 12,000 tons per day. The grade of this ore body was so much lower than the grade of ore which had been mined from the main ore body that costs had to be markedly decreased in order to mine the low grade ore at a profit.

It was found that some saving could be made in the general mining and concentrating expenses by increasing the production from 6,600 to 10,000 tons per day, but the major reduction had to be made in the cost of the direct mining operations. After a careful consideration of the various methods of mining, it was decided that the finger raise system of undercut caving, which was in successful operation at a number of other mines, was the best method for mining this ore body. The experience gained in mining the main ore body was used as a guide in modifying the finger raise system to fit local conditions. A portion of the low grade ore body which conformed to, and was readily accessible from the existing haulage and sublevels of the mine, was then developed for mining by this system.

The low grade ore body adjoins the main ore body on the north and lies at approximately the same elevation. It has an area of 81 acres, an average thickness of 315 ft. and is overlain by a barren leached schist capping varying in thickness from 245 to 500 ft. The ore body occupies a zone of secondary enrichment in a pre-Cambrian schist which has been extensively fractured. It varies from a hard, strong, highly silicified schist to a soft, kaolinized schist. The average assay value of the ore body, as estimated largely by churn drilling, is 0.936 percent copper, of which 0.104 percent is in the form of soluble copper and 0.832 percent is in the form of sulphide copper. The copper minerals occur principally in small fractures and cracks, and to a lesser extent disseminated through the ore body.

There was some uncertainty about the original estimated grade of this ore body, which had been largely determined by churn drill sampling, and, since a variation of as little as one-tenth of 1 percent of copper in the ore would have a material effect on the ultimate results of operations, it was imperative that the accuracy of the churn drill sampling be determined.

Results were obtained from accessible portions of the ore body by the following methods of sampling: Churn drilling; channel samples in drifts taken roughly across the major fracture planes; samples of ore broken in the driving of drifts; samples of cuttings from holes drilled with a dry stoper machine at right angles to the major fracture planes; samples of 6 to 8 tons, which were obtained by drilling and blasting out 2 ft. from the backs of drifts over sections 25 ft. in length, were carefully quartered and cut to assay size; and finally a sample of 1,500 tons, which was stoped out and run through the automatic sampler at the concentrator. A comparison of the results of these various methods convinced us of the accuracy of the churn drill sampling and those samples were and are accepted as correct. The ordinary drift channel samples were found to give results which were 13 percent high, and accordingly the assays obtained from all channel sampling are reduced by this amount to arrive at the true grade of the ore.

The size of the individual stopes was fixed at 150 ft. in width by 300 ft. in length. This was the minimum area of undercutting which produced satisfactory caving results in the harder portions, and the maximum area for the softer portions of the ore body. Larger undercut areas in the softer portions produced excessive weight in the drifts, raises and chute sets serving the drawing operations; costs were increased and control of drawing and production was seriously interfered with. From data on the main ore body, we knew that when a stope was at the peak of its production, drawing could be maintained at the rate of 1,000 tons per day per 12,000 sq. ft. of undercut area. At this rate, the maximum daily tonnage to be drawn from one stope would be 4,000 tons and three stopes would have to be in production to furnish a total output of 10,000 tons.

The stopes were laid out as shown in plan in Figures 1 and 2; the stope numbers indicate the order in which they are undercut and drawn. The arrangement provides that the caved capping in the first stopes mined shall be allowed at least one year in which to settle and consolidate before the adjacent stopes are undercut, and separate stopes which are to be drawn at the same time, so that congestion of trains on the haulage level is avoided. A partition of ore 15 ft. in width is left between stopes to prevent dilution of the ore in a producing stope with capping from an adjacent completed stope.

Figure 5 is a sectionalized isometric view of an individual stope 150 ft. in width by 300 ft. in length. This shows the relative locations of the workings as well as the relative heights of ore and capping encountered under average conditions. The haulage level is 130 ft. below the bottom of the ore. Each stope is served by two haulage drifts 150 ft. apart driven parallel to and 75 ft. from the end lines of the stope. The grizzly level is situated 100 ft. above the haulage level. The vertical distance between haulage and grizzly levels was made 100 ft. in order to utilize the existing levels in the mine. This provides for an economical combination of haulage level drifts and transfer raises. This distance may be varied to allow for the variations in the horizon of the bottom of the ore body with respect to the haulage level. A greater distance would result in a decrease in the amount of haulage level drifting and an increase in the footage of transfer raises needed to serve the same undercut area with the same raise interval on the grizzly level; it would also increase storage capacity in transfer raises. On the other hand, a vertical distance of less than 100 ft. shortens and simplifies the transfer raise system and provides a more accurate means of measuring and distributing the tonnage drawn. Three grizzly drifts spaced 50 ft. apart run lengthwise of the stope on the grizzly level. From pony sets on the haulage drifts, and directly under the grizzly drifts, three-branch transfer raises are driven in pairs which hole at 25 ft. intervals in the floors of the corresponding grizzly drifts; a grizzly is installed at each connection. From each grizzly a pair of grizzly raises is driven to connect with chute sets situated half way up to the undercutting level. From each square set four finger raises are driven to tap the undercutting level at intervals of 12½ ft. in each direction. The sketch illustrates a stope which has been completely undercut and partially drawn. The caving, which is shown as having progressed to about one-third the height of the ore, has obliterated the boundary caving drifts on the lower boundary caving levels.

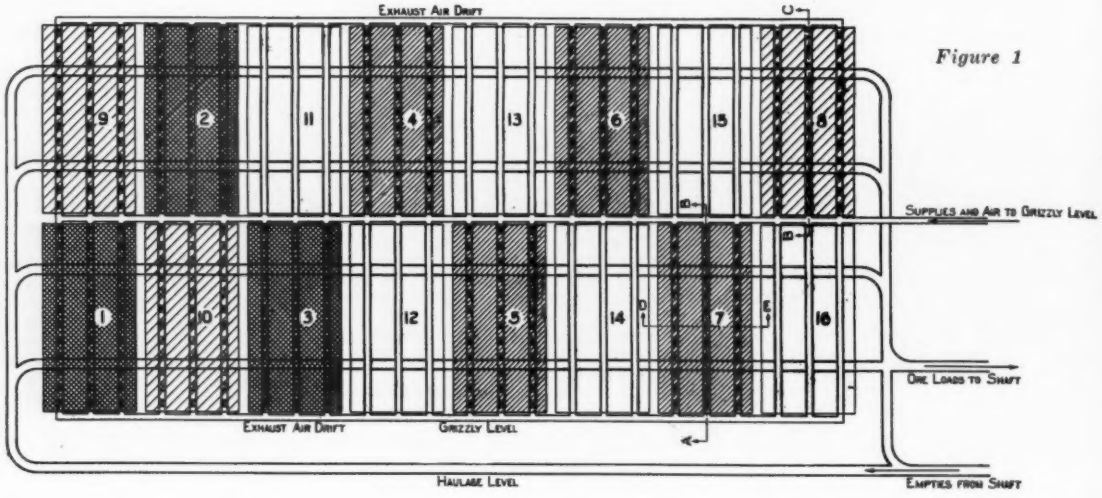
The grizzly level, shown in plan in Figure 1, is the base of operations for all undercutting and drawing and a considerable amount of development; 50 percent of the entire underground force is employed on this level and the undercutting level which is served by it; 85 percent of the supplies consumed in the mine are used on or distributed from this level. The importance of the grizzly level led to its careful planning with special consideration for adequate ventilation and efficient distribution of supplies.

The necessary blasting in drawing chutes during the shift requires a positive and strong circulation of air through each stope. Air is forced to the grizzly level and distributed through each stope grizzly drift from the center cross cut of the level and exhausts through the exhaust air drifts and exhaust air raises to the haulage level. The raises used for exhaust air are either transfer raises in completed stopes or transfer raises for proposed stopes driven in advance of development requirements. The circulation of from 3,000 to 4,000 cu. ft. of air per minute through each grizzly drift is required to properly ventilate it. The amount of air passing through each grizzly drift is regulated by means of air doors placed at either end.

* Presented before meeting of Arizona Chapter, American Mining Congress, Globe, Ariz., Oct. 10-11, 1927.

† Development Engineer, Miami Copper Company. Paper prepared in cooperation with J. H. Hensley, Jr., Mine Superintendent, and E. V. Graybeal, Chief Mine Engineer.

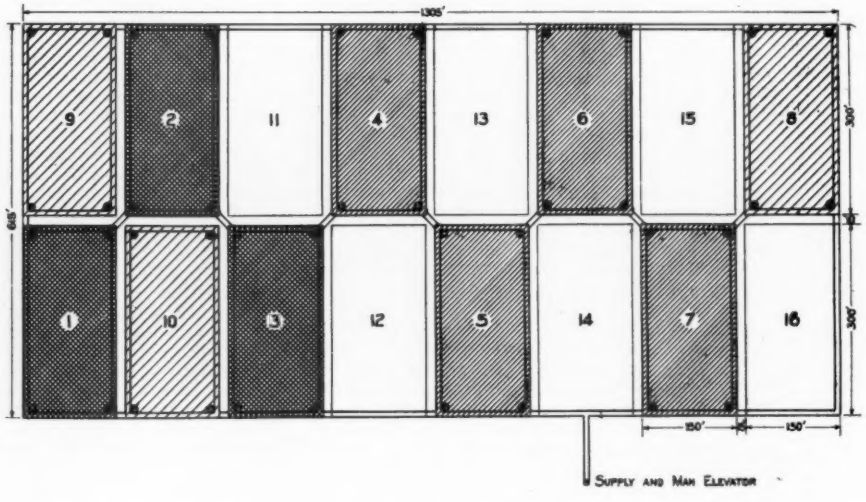
Figure 1



COMPOSITE PLAN OF HAULAGE AND GRIZZLY LEVELS
DAILY OUTPUT - 12,000 TONS
WITH
FOUR STOPES ON PRODUCTION

LEGEND
- COMPLETED STOPES
- PRODUCING STOPES
- DEVELOPING STOPES
- PROPOSED STOPES

Figure 2



PLAN OF TYPICAL STOPE BOUNDARY CAVING LEVEL

Trucks of supplies loaded on the surface are transferred to the grizzly level and delivered directly to each stope from the center crosscut.

A scheme for the control of the caving of the stopes to, but not beyond their predetermined boundaries, and to assist in the caving and breaking up of the ore in the stope was devised. The main object is to form vertical planes of weakness on all sides of the stopes to prevent the back of stopes from forming self-sustaining arches, which would obstruct the caving; at the same time it was necessary to avoid weakening the sides and ends so much that the back would cave and drop out in huge blocks, or possibly in a single large block, as would be the tendency if the stopes were cut off by continuous narrow shrinkage stopes on all sides. The entire back of the stope is placed under a heavy strain when the stope is undercut, and it tends to, and actually does, spall off in comparatively

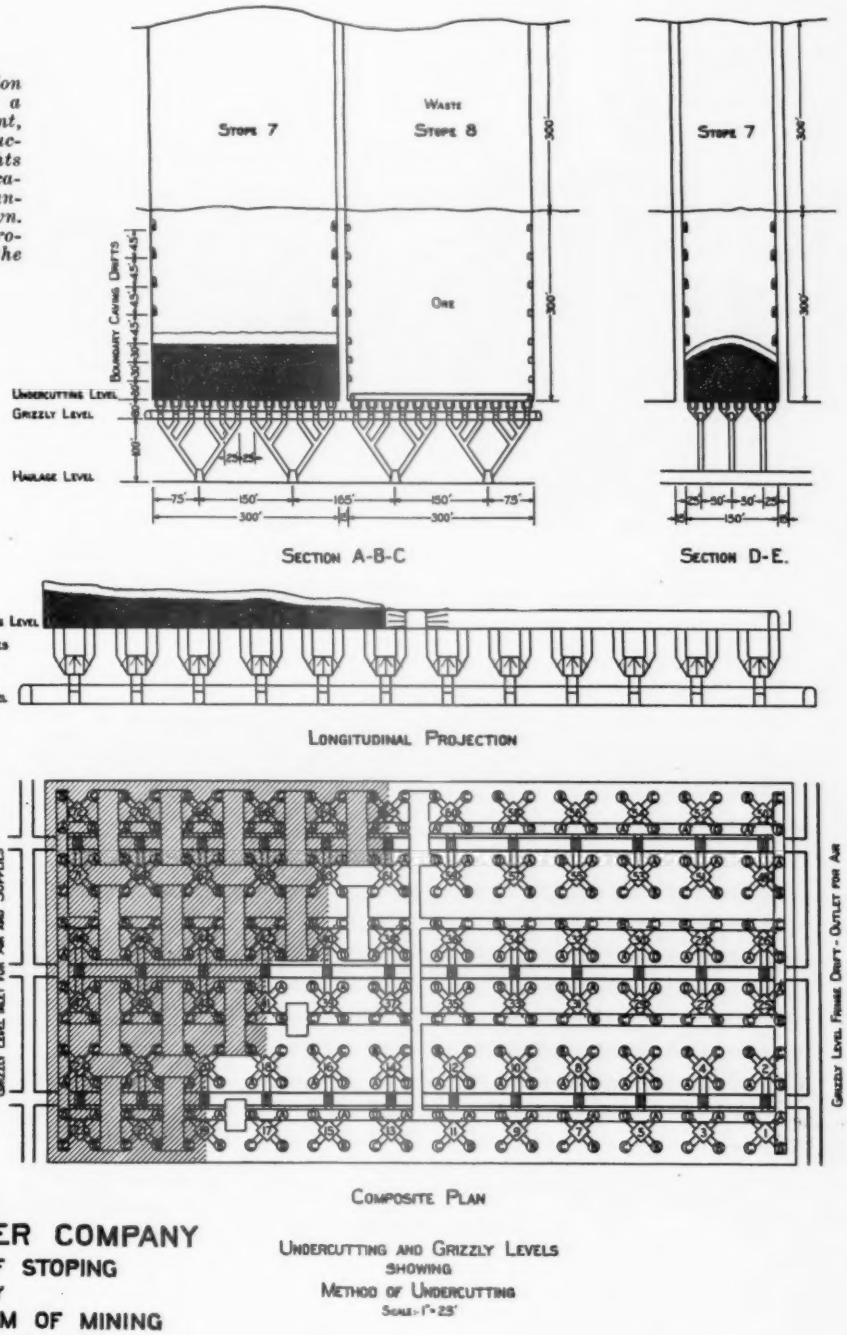


Figure 3—Longitudinal section of a producing stope and of a stope undergoing development, and cross section of the producing stope. The original heights of ore and waste, and the location of all development and undercutting openings are shown. The finger raises have been projected to the planes of the sections

Figure 4—Development of this stope has been completed. The shaded area in the plan shows the progress of the undercutting

small pieces from the center toward the boundaries, and finally breaks up along the boundary planes. Another object of the planes of weakness is to prevent the caving of ore beyond the stope boundaries. These objects are accomplished by driving boundary caving drifts around the perimeters of the stopes at various levels above the undercutting level, as shown in plan in Figure 2 and in sections in Figure 3. These drifts are driven from a conveniently located man and supply elevator, at vertical intervals of 30 and 45 ft., up to within 30 ft. of the top of the ore. This vertical interval could readily be varied to suit different classes of ground. After the boundary caving drifts are completed, the boundary planes are still further weakened by drilling and blasting out the backs of the drifts. These drifts are 4 ft. wide by 7½ ft. high, and the blasting out of their backs produces a cut 14 or 15 ft. in height above each sublevel. In order to further weaken the corners of the stopes where the tendency to cave is least, raises 4 to 5 ft. in diameter, are put up at each

corner from the undercutting level to the top boundary caving level; the raises are enlarged at each sublevel by drilling and blasting a cut 6 ft. deep out of the bottom of the boundary caving drift for a distance of 15 ft. along both drifts from the corner. The boundary caving drifts of later stopes serve as means of entrance to the corners of the stopes which have been undercut. From these drifts the actual breaking up and caving of the undercut ore may be viewed from time to time.

Development

To explain the sequence of operations in developing and undercutting a stope it is advisable to divide the latter into two zones, the zone above the undercutting level (see Figure 5) containing the boundary caving drifts, and the zone including the haulage, grizzly and undercutting levels. Work in the two zones is carried on simultaneously, but the boundary caving work should be completed, as a matter of safety, before the undercutting in the lower zone is started.

Although there is often a vertical interval of several hundred feet between operations in the two zones, the work is closely related. The program of drifting on the different levels is laid out to serve a group of stopes as a whole and is carried on in the same general area on all the levels. It is often necessary to put up a transfer raise from the haulage level to the boundary caving drifts to handle the muck from the latter. In this case a transfer raise is put up in one of the stopes which is to be mined well in the future, so that the raise can be used for development muck exclusively for a long period of time. Since the drifts at the beginning of the development of a group of stopes gradually progress farther and farther from the fresh air channels, raises must also be driven from the haulage level to the boundary caving drifts to provide circulation of air. After the drifts and raises for a group of stopes have been designated and the time limits for completing them have been set, it is the duty of the engineer in charge of development to see that the different operations are started on time and to keep the superintendent advised as to progress made.

The first development work on the lower levels is driving the haulage drifts. These are driven across the stopes at alternate intervals of 150 ft. and 165 ft. (see Figure 1) and are connected at each end by crosscuts. The empty ore trains enter the drift from one crosscut and the loaded trains leave them by the other as shown.

From the haulage drifts transfer raises are driven from pony sets installed on the regular drift sets; two raises from each pony set, one raise on each side of the drift. Pony sets are spaced 50 ft. apart, center to center, along the drift in each stope. The distance between adjacent chutes in two adjoining stopes is 65 ft. to allow for the 15-ft. pillar between stopes. Hand operated steel doors of the arc type are used in the chutes.

There are 12 main transfer raises to each stope. They are driven in a vertical plane at right angles to the haulage drift at an inclination of 55° 20′. They are 4 ft. by 4 ft. in section, and are 108 ft. in length from pony set to grizzly level. Figure 6 is a view of the development openings shown projected to the plane of the transfer raises; the chute sets and finger raises are in different vertical planes from the plane of the transfer raises and grizzly drifts as shown in Figure 7. The alignment and grade of a raise are obtained by sighting through a 4½-ft. length of ½-in. pipe suspended from spads in the back of the haulage drift by two light brass chains of such length that the pipe hangs at an inclination of 55° 20′. The spads are placed in the line of the raise by transit and a Brunton pocket transit is used to set the pipe at the proper inclination. The accuracy of the method is increased by placing a cap with a small hole in the center over each end of the pipe.

From each of the 12 main transfer raises of the stope two branch raises are driven at the same inclination and in the same vertical plane as the main raise but in the opposite direction. When driving the branches, the raise men obtain entrance from the grizzly level. It is safer to climb down 50 ft. from the grizzly level to the place where the branch raise takes off from the main raise than to climb up 50 ft. to the branch from the haulage level. Other advantages of entering from the grizzly level are that the main raise below the branch raise intersection is available for the storage of broken ore and that congestion on the haulage level is relieved. The transfer raises should be carried well in advance of the development of the stope on the grizzly level.

Table I shows the schedule for the development and undercutting of a stope. These schedules are prepared for each stope one year before production from that stope will be required. They also serve as progress records of the different operations. The schedule is shown in the first and last columns and the progress record in the intermediate columns.

The next work after the completion of the transfer raises is the driving of the grizzly drifts. Three of these, 50 ft. apart, are driven the length of the stope (see Figure 1). Every 25 ft. they connect with a transfer raise so the broken ore is shoveled directly into the raise or trammed to it in wheelbarrows. As soon as a grizzly drift has been driven a short distance past a transfer raise connection, a grizzly is built over the raise. This consists of three 45-lb. rails placed across the drift on two 10-in. by 10-in. stringers, and the necessary blocks and end pieces. There are four openings in a grizzly, each 10 in. wide by 4 ft. long. Grizzly drifts are driven 4 ft. wide by 6 ft. high.

From both sides of the grizzlies the grizzly raises are driven at right angles to the grizzly drift. They are 3½ ft. by 3½ ft. in size and are driven at an incline of 42 degrees for the first 14 ft. and then 9 ft. vertically. The chute set is afterwards installed in the upper part of the vertical section of the grizzly raise.

A uniform and close spacing of drawing points in the bottom of the stope is necessary for complete extraction of the caved ore in the stope and for proper control of the drawing of the stope. The chute sets, where the actual drawing is controlled, are located midway between the grizzly and undercutting levels and are spaced 25 ft. apart across and along the stope. From each chute set four finger raises are driven in line with the chutes to the undercut level, which they intercept at regular intervals of 12½ ft. from center to center, as shown in plan in Figure 4. The manner in which this regular spacing is obtained in the Miami mine is unique, and at the same time more easily and readily accomplished than is customary in other applications of this system. The chute sets are placed so that their sides form angles of 45 degrees with the ends and sides of the stope and with the line of the grizzly raise. (See Figures 4 and 7). The accurate location of the sills for the chute sets is the key to the correct spacing of the draw points, as the orientation of the chute set and the line of the finger raises are dependent upon it. The proper installation of these sills requires much skill. In order to orient the chute sets as described it is necessary to place one corner of the set directly over the inclined section of the grizzly raise. (See Figure 7.) Since it is only 2 ft. 2 in. from the turn in the raise to the bottom of the chute set, it is difficult to make the hitch for this corner without breaking the ground out to the inclined part of the grizzly raise. In making room for the sills two rows of holes, one row above the other and inclined upward, are drilled on all sides of the grizzly raise, a little above the level of the bottom of the sills. The top row of holes is blasted first in order to give an upward break. The hitches are then squared up by moiling. If the ground above the inclined section of the grizzly raise breaks out, an A-set must be placed by the sill contractor without extra compensation. Owing to the importance of correctly locating the chute set the alignment and elevation of each set of sills are carefully checked by the development engineer after they are completed and before the chute set proper is installed.

The next operation is the installation of the remainder of the chute set. Four finger raises about 3½ ft. in diameter are then driven from each chute set to the undercutting level.

The tops of all completed finger raises and transfer raises are inspected for missed holes by a boss or foreman before any drift connections are made with them, so that the men driving the drifts will not run a chance of drilling into a missed hole. The boss who makes the inspection records the fact by initialing the proper space on a chart of the stope, which is kept in a convenient place on the grizzly level. This chart also serves as a progress record of all the development work from transfer raise to undercutting.

Development work, commencing with the transfer raise is carried on in a predetermined order, depending on chiefly at which end of the stope undercutting is to start. If this operation is to be started at the north end and carried south, the grizzly drifts are started at the north end and driven south. The grizzly raises, chute sets and finger raises are completed in their turn, the work all progressing in the same direction. This sequence of operations makes it possible to start undercutting at the north end of the stope while the development work is being finished at the south end. An exception to the above rule of order is that chute sets and raises at the corners of the stope are completed before all others, because the finger raises at the four corners must be projected through to the boundary caving levels to facilitate the work on these levels. The sequence of operations is also planned so that chute sets and raises which connect with undercutting level drifts are completed before those which are not required until actual undercutting is under way.

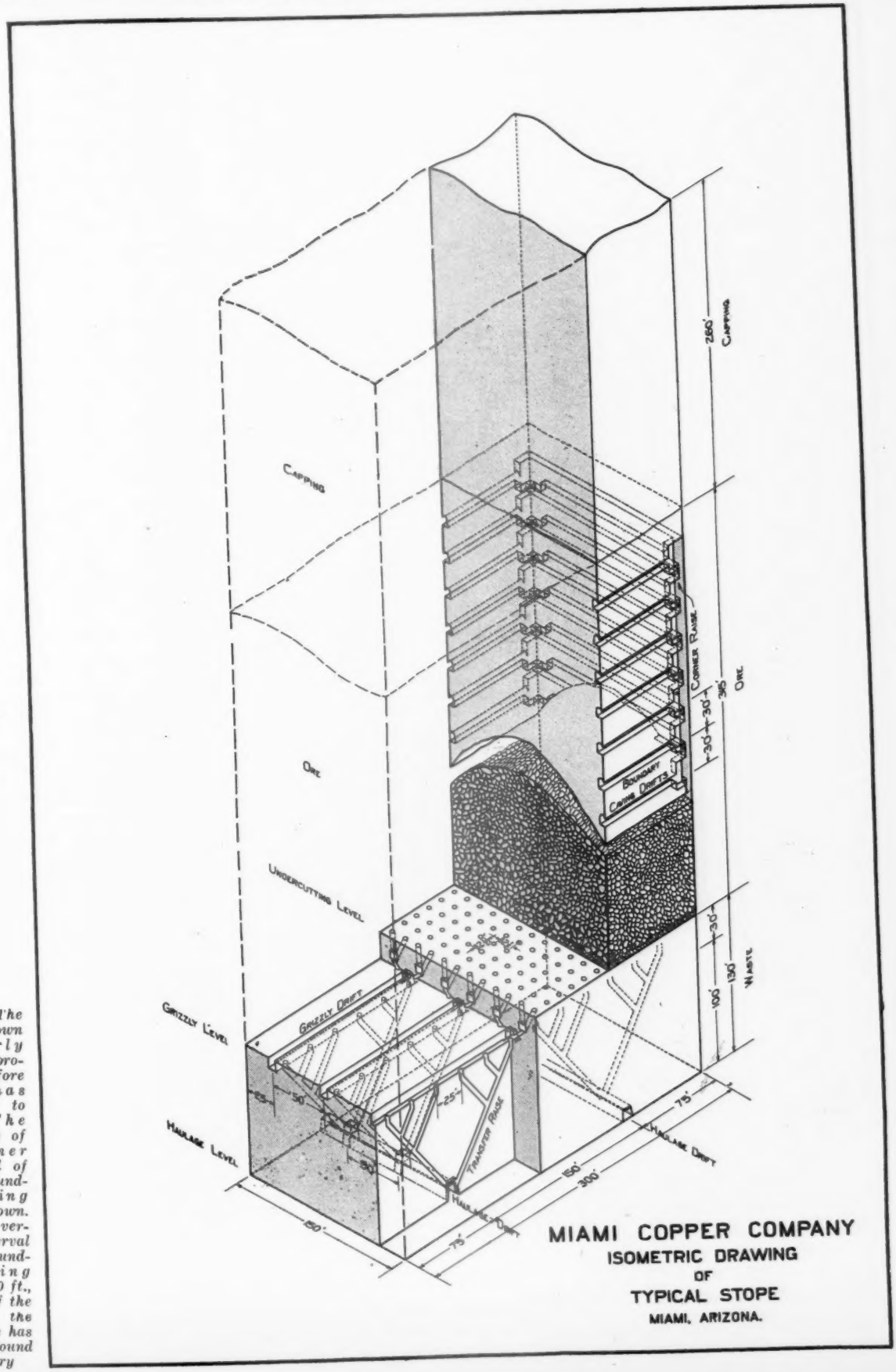


Figure 5—The stope is shown at an early stage of production before caving has progressed to surface. The enlarging of the corner raises and of the end boundary caving drifts is shown. Where the vertical interval between boundary caving levels is 30 ft., blasting of the backs of the side drifts has not been found necessary

To prepare the stope for the operation of undercutting four drifts and three crosscuts or fringe drifts are driven on the undercutting level. (See Figures 3 and 4.) The centers of the outside drifts are 18¾ ft. from the sides of the stope. The interval between drifts is 37½ ft. The end fringes are driven across the end rows of finger raises. Their centers are 6¼ ft. from the ends of the stope. The center crosscut is driven along the edge of a row of finger raises near the center of the stope so that the crosscut lies within areas that will be opened up during the undercutting.

Undercutting is started by enlarging one of the end crosscuts on the undercutting level into a cut 8 ft. wide and 22 ft. high. To raise the back of the crosscut to this height it must be drilled and blasted twice. The blasting is done in four sections, each section including 37½ ft. of the crosscut, and progresses across the stope in benches, i. e., while the second round of holes is being blasted along the the first section, the first round of holes is being blasted along the second section, etc.

After the work in the end of the stope is finished, the undercutting is done from the longitudinal drifts. (See Figure 4.) Starting at the end of the stope where the cut was made rooms 8 ft. wide by 25 ft. long are opened up at right angles to the longitudinal drifts as shown in the figure. The rooms are the same height as the drifts, or about 6 ft., and are made just long enough and wide enough to connect with the four finger raises at the ends of the room. The combination of rooms and drifts provides for the undercutting level connection with every finger raise before the final undercutting operation of undermining the pillars around the rooms. After the rooms have been opened up horizontal holes are drilled in their sides and one end in sufficient number to provide for the breaking up of the pillars. Rooms are opened up and blasted in order across the stope, as shown in plan in Figure 4, in such order that the line between the undercut area and the area being undercut lies diagonally across the stope. The backs of the rooms are not drilled except where the ground is exceptionally hard. When undercutting has reached the end of the stope, a vertical cut is made similar to that made at the start.

Instructions regarding workings which pertain to the development of a group of stopes as a whole are issued to the mining staff from time to time by the superintendent in typewritten orders; the work of developing and undercutting individual stopes is done according to the schedules for stope development previously described. It is the duty of the engineer in charge of development to assign the proper number of men to the different working places when the latter are ordered or scheduled to start; to see that the men best fitted to the different classes of work are put at that work, and to keep the superintendent advised of the progress of all development and undercutting work. Progress in individual stopes is recorded on the stope schedules (see Table I), which are the principal guides used by the development engineer in distributing the men. The different operations in each stope are kept on schedule by varying the men assigned to them, but the total number of men on development and undercutting is kept at a very constant figure.

The undercutting and development work is more lucrative for the miners than any other work in the mine, since all of it is done on contract. The best and steadiest men naturally gravitate to the job at which they are the most skillful and at which they can make the most money. The work is done best and quickest by keeping the same men at the same jobs and the rate of progress can be more reliably estimated than it could be if the work was done by men inexperienced in this work. If the supply of men for any kind of work runs short, recruits are taught the work by placing them with the experienced workmen.

Contract work is done on the piecework system with regular wages guaranteed. The development engineer keeps records of the amount of work done on contract (except the raises and drifts which are measured by the surveyors) and sets the rates to be paid. It is therefore his duty to see that the work is done correctly before it is paid for.

Table II shows contract rates for labor only, distribution of men, and rates of progress for the different development operations. The driving of the boundary caving drifts requires a fairly constant number of men. A drift crew on this work consists of a machineman and a mucker who work together in the same face. Many of the crews have been on this work exclusively since it was inaugurated. On the grizzly level it is possible to assign to one crew a number of places which they can work simultaneously. It is not unusual for a grizzly raise man to drill rounds in two raises, blast them at lunch time, and repeat the performance in the latter half of the shift. The chute set and finger raise crews need to have a number of working places, because after a round of holes is blasted for a chute set or in a finger raise some time must elapse before the smoke and gas clear out, since these working places are necessarily dead ends. One crew, composed of a timberman and machineman, installs practically all the grizzlies in the mine. A similar crew installs all the sills for the chute sets. Undercutting is intermittent since a stope is usually undercut in less than two months and new stopes are brought into production at the rate of one every three months. The miners who work at the undercutting must, therefore, be assigned to other work about one-third of the time. This is not difficult as most contractors are proficient at two or three different kinds of work. Records are kept of each man's performance at each type of work as an aid in making the proper assignments.

Unit costs of development and undercutting operations are shown in Table III. These costs represent the direct charges only, i. e., direct supervision, labor and supplies and transfer of rock broken to the haulage level. They do not include any charges for electric haulage, hoisting, ventilation or other general underground mining expenses. The cost per chute set shown in this table includes the cost of chute set and grizzly raise combined as one unit.

All the contracts in the mine are listed in typewritten orders, which are revised and reissued daily by the development and stope engineers. The numbers of the contracts and the location and description of the work to be done are given as well as any orders which the superintendent, assistant superintendent, foreman or surveyors wish transmitted to the bosses. Each foreman and boss receives a copy of the orders which apply to his section of the mine. They are issued daily at the beginning of the 3 p. m. shift, are passed on at the end of that shift to the 11 p. m. shift, and from the latter to the 7 a. m. shift. The development and undercutting work is done chiefly on day shift, so orders for this work are issued in the morning.

Drawing

Chute sets are numbered from 1 to 72 as shown in Figure 4. Chutes are lettered A, B, C, D, in a clockwise direction, starting with the chute which is over a man's left shoulder as he goes up the grizzly raise. Drawing operations are directed by stope engineers, each of whom supervises two stopes. Under the stope engineer are a draw boss, sealer, and a varying number of chute tappers and chute blasters on each of the three shifts. The stope engineer prepares a drawing schedule daily which lists the individual chutes which are to be drawn and the amount to be drawn from each.

Normally the daily orders call for the drawing of 50 tons from each chute specified, and each shift is assigned a specific chute in all sets that are to be drawn, i. e., one shift is assigned "A" chutes, the following shift "B" chutes, and so on. It is desired, and every effort is made, to draw each stope evenly over its entire area, and drawing orders are essentially for this purpose. The necessity of varying the rate of drawing from individual chute sets and chutes is due to the following factors: The actual condition of the individual chute as observed by the drawing engineer, as to the presence of capping or low grade ore, state of repair of and amount of weight on the chute set; distribution of required production among the different stopes, necessity of regulating the grade of the total production, and the distribution of tonnage to facilitate haulage operations.

The stope engineer inspects every day all chutes listed on the draw sheet. He notes the condition of the ore in all the chutes, removes chutes in which capping shows from the drawing list, lists the chutes which need drilling or blasting, and in general makes sure that drawing is proceeding according to instructions. Chutes in which capping shows up prematurely are sealed for two or three weeks before being placed on the drawing list again. During this period the drawing of the chutes around the sealed one breaks up the wall of the funnel, and the chute may then be unsealed and ore drawing resumed with satisfactory results.

Chutes running ore of questionable grade are from time to time placed on the orders for a trial draw of 25 tons, and are then inspected and sampled before being again drawn regularly.

The total tonnages drawn from each chute are posted in the stope engineer's notebook every two days by the tonnage clerk. At the end of each half month the total estimated tonnage remaining in each chute is posted. Longitudinal stope sections for every line of chutes based on remaining tonnage are also carried in these notebooks. The stope engineer thus has with him when he goes through the stope an accurate record of the stope's condition, which is always within two days of being up to date.

The engineer is also guided in making out his drawing orders by reference to plans of sublevels and numerous sections through the stope which have been previously prepared and which show detailed geology, intrusions of capping, oxidized ore and low-grade ore into the stope.

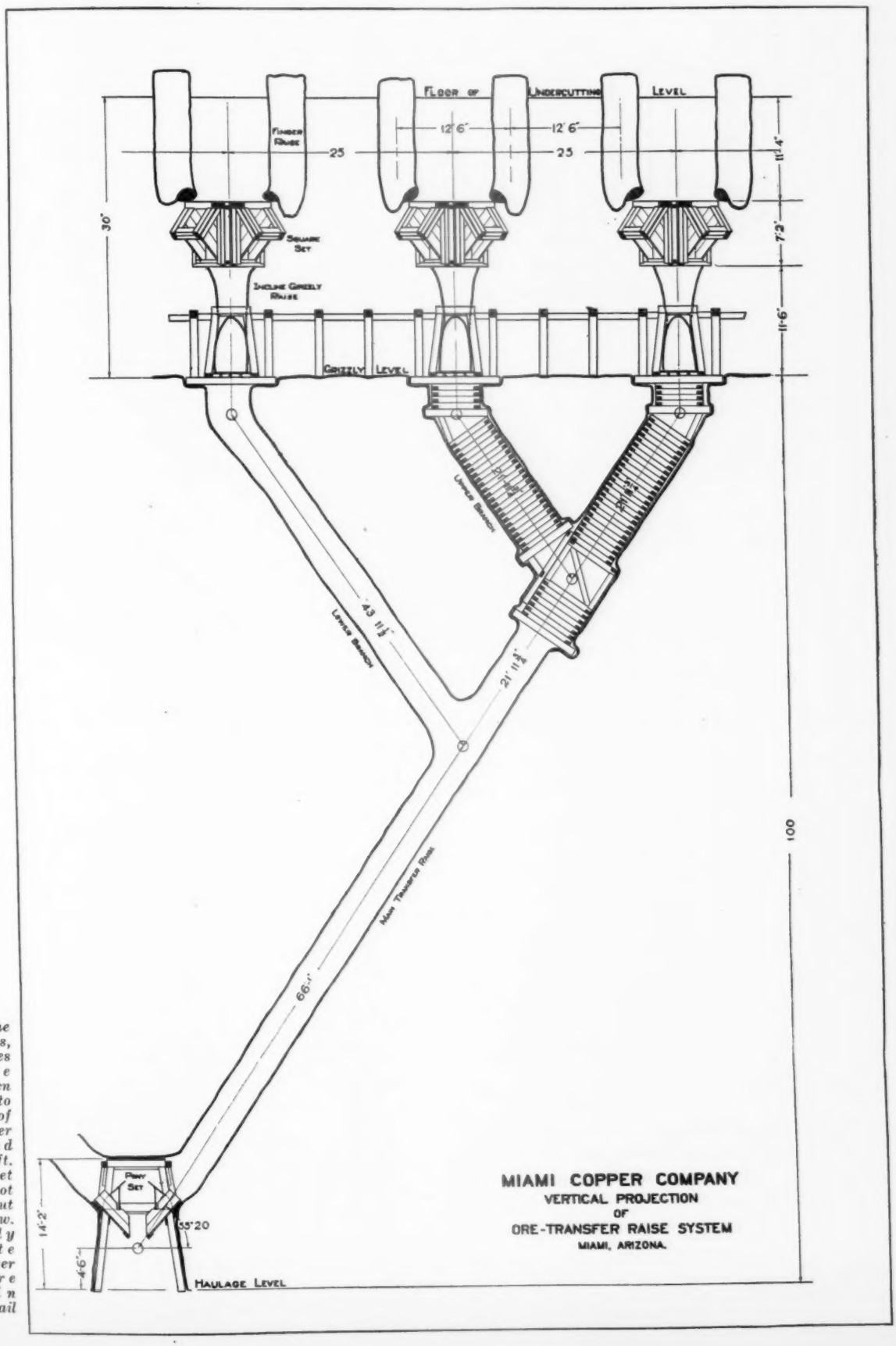


Figure 6—The finger raises, grizzly raises and chute sets have been projected to the plane of the transfer raises and grizzly drift. The chute set is shown, not in section, but as a side view. The grizzly raise, chute set and finger raises are shown in greater detail in Fig. 7

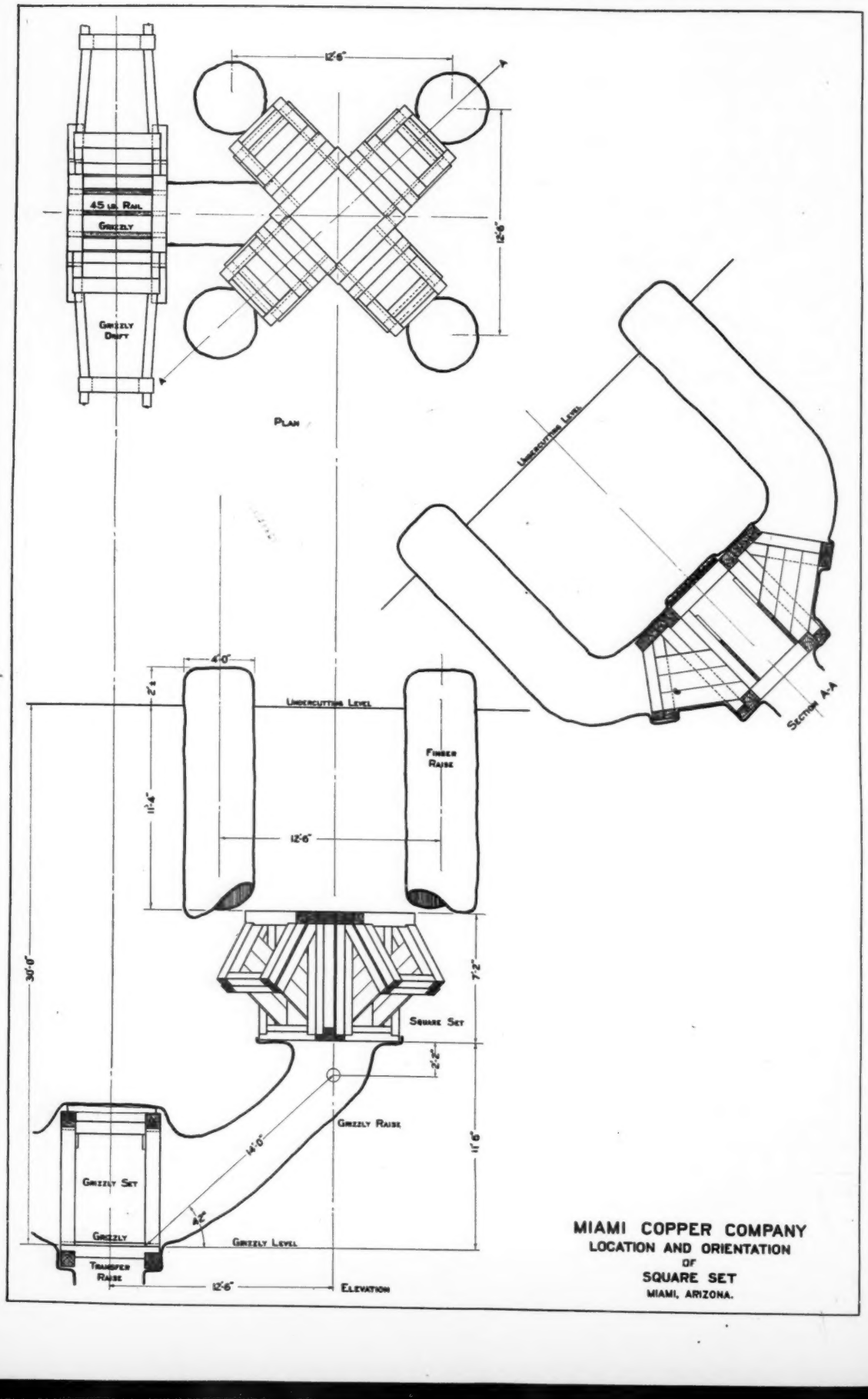
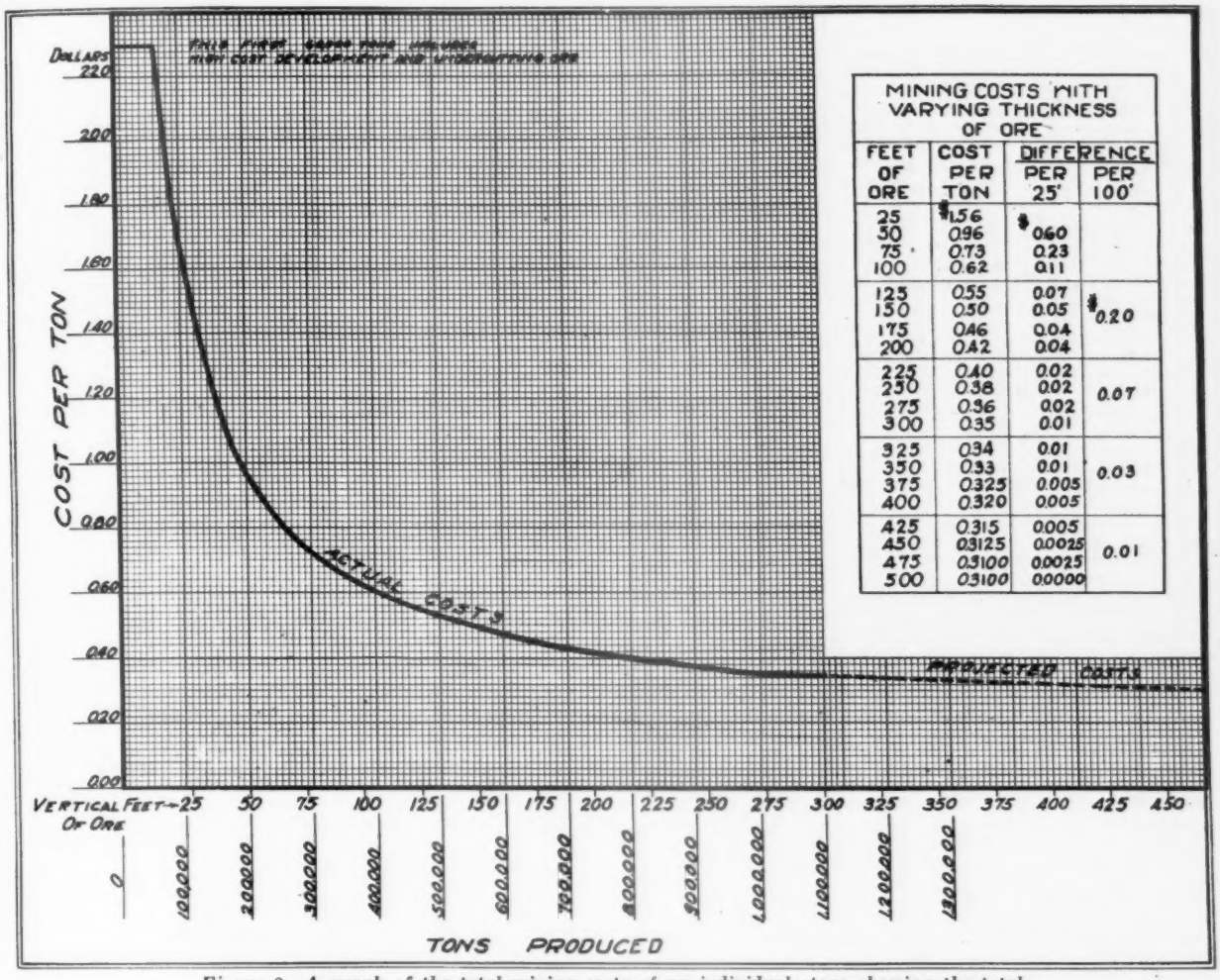


Fig. 7—A side view of the chute set and sectional views of the grizzly raise and finger raises are shown in the elevation. The plan shows the orientation of the chute set with respect to the grizzly drift



MINING COSTS WITH VARYING THICKNESS OF ORE

FEET OF ORE	COST PER TON	DIFFERENCE PER 25'	DIFFERENCE PER 100'
25	$1.56		
50	0.96	$0.60	
75	0.73	0.23	
100	0.62	0.11	
125	0.55	0.07	$0.20
150	0.50	0.05	
175	0.46	0.04	
200	0.42	0.04	
225	0.40	0.02	0.07
250	0.38	0.02	
275	0.36	0.02	
300	0.35	0.01	
325	0.34	0.01	0.03
350	0.33	0.01	
375	0.325	0.005	
400	0.320	0.005	
425	0.315	0.005	0.01
450	0.3125	0.0025	
475	0.3100	0.0025	
500	0.3100	0.0000	

Figure 8—A graph of the total mining costs of an individual stope showing the total costs per ton for stopes of varying thicknesses and tonnages of ore

Marker blocks with brass number tags, 12 in. by 12 in. by 12 in., placed in holes bored in two faces of the blocks, are planted at 25-ft. intervals around all the boundary caving drifts and in such other locations in the stope as are accessible on the boundary caving levels. The brass tags are marked with the number of the stope, the level on which the block was planted, and its location. When, during the drawing of the stope, the blocks come out on the grizzly level, the set and chute through which each block comes is noted. The position from which muck is coming can thus be ascertained whenever a block is recovered. The places where the blocks are planted and the places where they come out on the grizzly level are platted. If the blocks drop vertically, it is evident that the ore is being drawn correctly, i. e., each finger raise is drawing the ore directly above it. Where a block shows much horizontal movement, the finger raise through which it is recovered is drawing ore that should come through another raise, and the drawing is corrected accordingly.

The draw boss makes out drawing lists for his tapper crews from the draw sheet furnished him by the stope engineer and supervises the work of drawing the ore. A tapper crew consists of a chute blaster and chute tapper, one of whom draws the ore from the chute set while the other keeps the grizzly clear. If the chute hangs up, the chute blaster attempts to bring it down by blasting. The draw boss also has chute blasters who do not draw ore but blast the difficult chutes to get them ready for the tapper crews, and chute drillers who drill and blast packed chutes. In all chute blasting, except that in drilled chutes, electric blasting caps are used which are detonated by means of small hand batteries. The advantages of electric caps over fuse and ordinary caps are:

1. Possibility of a bomb, already spit, falling down the transfer raise is avoided.
2. Bombs can be placed in high chutes to better advantage.
3. Less delay is caused on account of smoke.
4. No delay is caused in waiting for missed holes.

Sealing of chutes is done by tacking a strip of cardboard to the chute door and chute side in such a way that the door can not be removed without breaking the seal. The latter is marked with the date, shift and initials of the sealer. Sealing is done by the draw boss and sealer working in conjunction. All chute sets on the drawing list are inspected before the tapper crews enter to make sure that all chutes are sealed. The same sets are inspected after drawing is finished, for the purpose of sealing the chutes which have been drawn and to note any infractions of drawing instructions. The sealer also visits all chute sets in the stope, not on the drawing list, to see that the seals are all intact.

The maintenance of chute sets, grizzly raises, grizzlies, grizzly drifts and transfer raises is closely related to and materially affects all drawing operations. The stope engineer inspects and records the condition of all stope openings and lists all repair work in the order in which it is to be done. The order is determined by the drawing requirements. About 75 percent of this maintenance work is done on contract by a crew whose number is fairly constant and who have been specially developed for this class of work. The stope engineer assigns all contracts, designating what men are to be placed and the rate to apply on each contract.

When the finger raise system of mining was first started, it was attempted to measure the amount of ore drawn by means of trap doors, which were installed about 20 ft. below the grizzlies. The number of tons which each raise would hold between the door and the grizzly was computed. The doors were held shut by ¼-in. cables which ran from the door to the grizzly through ¾-in. pipe. On

the grizzly end of the cable there was a handle which hooked over an iron pin in a post. When the hook was released from the pin, the door opened of its own weight. The system gave an accurate check on the distribution and the amount of ore drawn but was discarded for a number of reasons. The ore had to be drawn slowly when the pocket had been nearly filled so as not to flood the grizzly. The man in the chute set could not tell when the pocket was full, but had to draw according to the instructions of the man on the grizzly. As a result, drawing had to be stopped and started several times before the right amount was drawn. Difficulty was experienced in emptying the pocket. The door opened easily enough, but large boulders often caught on the timbers to which the door was fastened and either blocked the opening or formed an arch over it. Much delay ensued because the boulders could seldom be dislodged except by blasting. The blasting was hard on the doors and cables and many had to be replaced.

When the trap-door system was discarded, the method of ore measurement now in use was adopted. Each tapper crew is assigned to chutes which discharge into several main transfer raises. These chutes are listed in the order in which they are to be drawn, so that an interval of at least 30 minutes occurs between the time of drawing two different chutes into the same transfer raise. This allows time for the haulage level train crew to load and record the cars drawn from each chute separately. The tapper crews estimate the amount of ore drawn each time and the train crews measure it by keeping account of the cars drawn. The tapper crew mark on their list, opposite each chute drawn, the estimated tonnage, the time when drawing was started, and the time when drawing was finished. The draw boss at the end of the shift combines the tapper crew reports on a draw boss report sheet. (Table IV.) The draw boss uses the upper half of the space allotted to each transfer raise for his report; the time elapsed in drawing the chutes is shown graphically by a horizontal line; the tonnage estimated to have been drawn is marked above the time line, while the number of the chute is marked below the line. The motorman on the haulage level makes out a report which shows the time loading of his train was started and the time when loading was finished for each trip made during the shift, the numbers of the transfer raises drawn, the order in which they were drawn, and the tonnage drawn from each raise for each trip. The tonnage clerk combines the motorman's report with the draw boss report as shown. The encircled figures are the tonnages arrived at by the tonnage clerk in combining the two reports. When a train leaves a transfer raise hung up or with ore in it, the tonnage drawn on one trip must be combined with the tonnage drawn on the following trip when the raise is pulled empty. The tapper crew's estimates of tonnage drawn average about 90 percent of the actual tonnage as reported by the motormen on the haulage level. After the tonnage clerk has transferred the calculated tonnages to his record books, these reports are returned to the draw bosses so that they may see how closely their tappers are estimating.

The ore is transferred on the haulage level from the transfer raises to the 800-ton skip loading pocket in trains, consisting of thirty 78 cu. ft. gable bottom

TABLE I—DEVELOPING AND UNDERCUTTING SCHEDULE AND PROGRESS RECORD NO. 6 STOPE

	Scheduled to start	Started	25% Complete	50% Complete	75% Complete	Completed	Scheduled to complete
Transfer raises	Jan. 1	Dec. 20	Jan. 29	Mar. 14	May 13	June 10	June 1
Grizzly level drifts	Mar. 15	Feb. 11	Mar. 15	Apr. 30	May 25	June 24	June 15
Grizzly raises	Apr. 15	Apr. 3	May 1	May 15	June 10	June 30	Aug. 1
Chute sets	May 1	Apr. 15	May 5	June 5	July 7	Aug. 11	Sept. 1
Finger raises to undercuting level	May 15	May 15	June 5	July 1	Aug. 15	Sept. 25	Oct. 1
Undercutting level drifts	Aug. 1	July 6	Aug. 2	Sept. 2	Sept. 20	Oct. 6	Oct. 1
Undercutting	Oct. 1	Oct. 12	Nov. 8	Nov. 15	Nov. 27	Dec. 10	Dec. 1
Boundary caving drifts	Feb. 1	Jan. 1	Mar. 5	May 20	July 10	Aug. 25	Sept. 1
Drilling and blasting boundary caving drifts	Sept. 1	Aug. 25	Sept. 6	Sept. 18	Sept. 30	Oct. 12	Oct. 1

TABLE II—DISTRIBUTION OF DEVELOPMENT AND UNDERCUTTING CREWS WITH AVERAGE PERFORMANCE AND CONTRACT RATES

Kind of work	Crew	Man shifts required per unit	Feet advance per man shift	Contract rate for labor only	Total number of men assigned to operation
Boundary caving drifts	1 machineman, 1 mucker	.....	2.5	$2.75 & $3.00 per foot	40
Transfer raises	2 machinemen	.....	4 to 4.5	$1.75 per foot	6 to 8
Grizzly drifts	1 machineman	.....	5	$1.50 per foot	2 to 4
Grizzlies	1 timberman, 1 machineman	1⅓	.....	$10 & $12 per grizzly	2
Grizzly raises	1 or 2 machineman	2	11	$18 per raise	2 to 6
Chute set sills	1 timberman, 1 machineman	2	.....	$20 per set	2 or 3
Chute sets	1 timberman, 1 machineman	5 to 6	.....	$42 to $47 per set	8 to 14
Finger raises	2 machinemen	1½	10	$10 & $12 per raise	4 to 8
Undercutting	4 machinemen	12	.....	$75 per room	12*
Undercutting level drifts	1 machineman	.....	8	$0.80 & $1.00 per foot	2 to 10*

* Intermittent.

TABLE III—REPRESENTATIVE DEVELOPMENT AND UNDERCUTTING UNIT COSTS

	Work done	Labor	Supplies	Air drill expense	Total per unit
Haulage drifts	6,700 ft.	$11.03	$5.21	$1.41	$17.65
Haulage track, trolley wire & bonds	7,595 ft.	1.08	1.42	.....	2.50
Boundary caving drifts	12,179 ft. (untimbered); 3,536 ft. (timbered)	4.63	1.77	.86	7.26
Transfer raises	3,775 ft. (untimbered); 515 ft. (timbered)	3.62	2.21	1.05	6.88
Chute sets	666 sets	177.11	132.61	47.31	357.03
Finger raises	4,608 ft.	.90	.62	.36	1.88
Undercutting level drifts	1,500 ft.	1.14	.85	.50	2.49
Undercutting	45,000 sq. ft.	.12	.07	.03	.22

DRAW BOSS REPORT

N 850 HAULAGE DRIFT STOPE № 7 DAY SHIFT Aug. 15 1927

TRANSFER RAISE		7 AM	8	9	10	11	12 M	1 PM.	2
E 17 N	DRAW BOSS REPORT	50 7-A (56)					50 8-A (52)		
	HAULAGE REPORT	56-E						52-E	
E 17 S	DRAW BOSS REPORT	25 1-A (24)					40 2-A (36)		
	HAULAGE REPORT	12-M						48-E	
E 67 N	DRAW BOSS REPORT		50 31-A (48)					25 32-A (28)	
	HAULAGE REPORT			48-E				20-M	8-E
E 67 S	DRAW BOSS REPORT			50 25-A (60)					50 26-A (56)
	HAULAGE REPORT				60-E				56-E
E 117 N	DRAW BOSS REPORT				20 53-A (12)				25 56-A (28)
	HAULAGE REPORT				12-E				28-E
E 117 S	DRAW BOSS REPORT					50 49-A (28+)			
	HAULAGE REPORT								28-M

LEGEND { M = MUCK LEFT IN RAISE; E = RAISE LEFT EMPTY; H = RAISE HUNG UP }

DRAW BOSS

Table IV—Combined haulage level and draw boss reports showing method of allocating tonnages drawn from transfer raises to individual chutes

TABLE V—TOTAL MINING COSTS OF THE THREE STOPES WHICH HAVE BEEN COMPLETED

	Costs per ton	
Total tonnage produced		3,450,260
Haulage level drifts	$0.0099	
Haulage level tracks	.0010	
Haulage level trolley and bonds	.0004	
Haulage level loading chutes	.0018	
Transfer raises	.0173	
Grizzly level drifts & grizzlies	.0121	
Chute sets and grizzly raises	.0282	
Total development		$0.0707
Finger raises to undercutting level	.0111	
Undercutting level drifts	.0062	
Sub level boundary caving drifts	.0369	
Undercutting on undercutting level	.0137	
Total stoping		.0679
Drawing	.0477	
Maintenance of chute sets, grizzly level and raises	.0214	
Total drawing		.0691
Total cost of ore delivered to haulage level		$0.2077
Electric haulage	.0587	
Hoisting	.0375	
Pumping	.0020	
Ventilation and sanitation	.0190	
Lighting	.0028	
General underground expense	.0124	
Engineering and sampling	.0135	
Mine surface	.0226	
Mine accident	.0097	
		.1782
Total mining cost		$0.3859

TABLE VI

	Tons per shift		
	Drawing	Maintenance	Total
Blasters	319	.....	319
Tappers	401	.....	401
Tbrmen and helpers	5,546	440	408
Machinemen	1,465	6,365	1,282
Muckers	2,454	4,350	1,569
Sealers	1,774	.....	1,774
Bosses	1,645	7,372	1,345
Stope engrs.	5,538	50,004	4,986
Miscellaneous	65,099	3,698	3,499
Total	121	324	88
Total shifts	28,471	10,643	39,114
Total tonnage drawn			3,450,260

side dump cars, hauled by two 6-ton trolley locomotives operating in tandem. Four trains on each of three shifts are required to handle the stope production. The track grade is 0.4 percent in favor of the load. The average distance of the round trip from transfer raise to the shaft is 8,000 ft. A train crew consists of one motorman and two trainmen, who load cars from the transfer chutes and dump them in the skip loading pocket. Each train hauls an average of 950 tons per eight-hour shift. The haulage cost, including loading, hauling, dumping, maintenance of haulage level and equipment, is $0.068 per ton-mile.

The ore is hoisted to a 1,000-ton ore bin at the surface crushing plant by two 10-ton skips operating in balance at the rate of 650 tons per hour.

The total production to August 1, 1927, by this system was 7,371,506 tons of ore. Eight stopes have been developed and undercut, and of these stopes 1, 2 and 3 have been completely drawn. Numbers 4 and 5 have yielded their estimated tonnage, but are still producing a small amount of ore. Stopes 6, 7 and 8 are furnishing most of the tonnage requirements. Stopes 9, 10 and 11 are in various stages of development.

The costs of mining 3,450,260 tons of ore produced from stopes 1, 2 and 3 are shown in Table V.

Mining costs for a single stope are shown graphically at various stages of production in Figure 8. The abscissae represent the number of tons yielded at any stage of production. They also represent the heights of ore above the undercutting level equivalent to the different tonnages. The tonnage credited to each stope includes the production from development work for that stope. This amounts to approximately 20,000 tons per stope, and largely accounts for the high cost per ton of the early production from the stope. The ordinates represent the total accumulated cost in dollars and cents per ton at all stages of production. In the upper right-hand corner of this chart is a table based on these costs. This table shows the total mining costs per ton for developing and mining stopes of various thicknesses of ore and the reductions in costs for increasing thicknesses of ore. These mining costs include development cost of $0.0707 per ton, which represents the actual cost of haulage level drifts, transfer raises, grizzly level, grizzly raises and chute sets for that portion of the ore body served; direct stoping cost, which includes finger raises to undercutting level, opening up and blasting in the undercutting level, and all work in connection with the boundary caving drifts and stope corner raises above the undercutting level; all drawing expenses and maintenance of square sets, grizzly level and transfer raises, and the general mining costs, which include haulage, hoisting, lighting, ventilation, pumping, general underground expense, engineering, sampling, mine surface and accident expenses. These costs do not include general expenses of administration, taxes, etc.

The average number of tons mined per man underground for the year 1926 was 28.2 tons. The average number of tons mined per man in the mine department for the same period was 24.35 tons.

Data of labor performances in the drawing operations are shown in Table VI.

The cost of explosives used in drawing was $0.0063 per ton of ore; 34.51 tons of ore were drawn per pound of explosives. Timber used in drawing and maintenance of chute sets, grizzly raises, grizzly drifts and transfer raises amounted to .21 ft. b. m. per ton.

Average number of tons of ore drawn from each chute set was 15,541 tons. Average number of tons of ore transferred through each transfer raise was 93,246 tons.

EXTRACTION DATA FOR THE FIRST THREE COMPLETED STOPES

Estimated tonnage undercut	2,861,995
Tonnage produced	3,450,260
Percentage of estimated tonnage recovered	120.554%
Estimated grade of ore undercut	1.1142%
Grade of ore produced	1.0097%
Percentage grade extraction	90.621 %
Percentage copper extraction	109.243%

The high copper and tonnage extractions which are shown are accounted for in part by the drawing of low grade capping, overlying gob and some overlying oxide ore which were not included in the ore estimates.

Average daily production from each of these stopes for the entire period in which drawing operations were conducted, was 3,124 tons; 90 percent of the total production was produced at the rate of 4,000 tons per day.

Accurate records were kept of the condition of all ore drawn from each individual chute and the combined results of the three stopes showed that 78 percent of the original estimated tonnage was drawn clean with no admixture of waste capping. Dilution with capping first occurred when about 25 percent of the estimated production had been obtained.

This paper was prepared by J. H. Hensley, Jr., mine superintendent; E. V. Graybeal, chief mine engineer, and A. J. McDermid, development engineer.

TREASURY DEPARTMENT FILES ANSWER TO SILVER PRODUCERS SUIT

The answer of the Treasury Department to the suit of the American Silver Producers' Association, to compel the purchase by the Treasury of 14,589,730 ounces of silver at $1 per ounce to complete transactions under the Pittman Act, was filed in the District of Columbia Supreme Court October 17.

The government asked the court to dismiss the suit on the ground that the requirements of the Pittman Act have been fulfilled and that mandamus compelling the purchase of this silver would have the effect of enforcing a contract against the government without its being a party to the proceedings and without its consent. It is pointed out that the silver interests "have a plain, complete, and adequate remedy at law by suing in the Court of Claims."

The government's brief says that because silver is now selling at 55 cents an ounce, the purchase by the government of the silver involved at $1 per ounce "would mean a gift of $6,493,529 to producers of silver and throw upon the Treasury the burden of carrying at an artificial price 15,000,000 ounces of silver which is not needed by the government.

"The claim of the silver interests is based upon a technical and unwarranted interpretation of the Pittman Act as applied to transactions in the Treasury. They contend that the transactions were irrevocable allocations of silver for subsidiary coinage under the act."

Contention is made that the acts which the silver interests seek to compel the Treasury to perform are not purely ministerial. It is claimed that the Pittman Act states that the silver purchased from American producers "may be resold" for subsidiary coinage "under rules and regulations to be established by the Secretary of the Treasury." The act also states that "sales" of silver bullion "may be made" for subsidiary coinage.

"There was nothing in the Pittman Act which prevented the Treasury from purchasing silver for subsidiary coinage from other than the American silver producers at any time during the period that purchases were being made to restore the silver-dollar situation," says the answer. "The Secretary could have purchased silver for subsidiary coinage in the open market on competitive bids without regard to whether the silver was of American or foreign origin at any time during that period."

GOVERNMENT OWNERSHIP

(*Continued from page* 816)

cent of the local and state tax burden. "If amusements, food, clothing and necessities were all taxed," says this writer, "the people would be quick to realize their burden."

The ability of government to issue tax-exempt securities at artificially high prices compared with the rates of interest paid, offers an incentive to make large expenditures upon public works of various kinds, which probably would not be provided by private capital. It is a remarkable fact that almost everybody complains of mounting taxes and yet a majority of those who go to the polls usually vote for every proposal to make public expenditures and thereby increase the taxes.

Opposed to one of the writers quoted above is one who believes that if a private and bonded company were operating the Post Office Department, it would be able to reduce postage rates, with improved service, instead of producing an annual deficit.

A large national association says that by building up favorable public relations, government encroachments will be prevented. State boards of control, state budget bureaus, and similar bodies are recommended to control expenditures of the taxpayer's money.

One group advocates a reorganization of all government agencies and placing the responsibility for their operation directly upon the shoulders of the President of the United States (!).

"Some day," says a well-known lawyer, "The American will learn what is undreamt of in his philosophy, that there are human interests greater than the desire for efficiency, size and high organization. The American is wholly indifferent to centuries of experience in government, wholly indifferent to any philosophy of life than that of economic achievement. When he realizes his view is not eternal verity but a mere hypothesis as against other hypotheses, he will be willing to study the experience of other nations. Then, he will realize that the oiled machinery of paternal government is run at the sacrifice of much that is vital to a sound national life."

In all the instances quoted by these hundreds of replies, none offers a more interesting case than that of the state-operated Barge Canal in New York. The state maintains a traffic bureau which urges shippers to patronize the canal and gives full information regarding rates charged by the parties who operate boats on it. This waterway and service the state provides free of cost for the use of those who directly compete with a number of the largest taxpayers of New York.

This canal is a heavy drain upon the resources of the state. More than $230,000,000 of the taxpayers money has been spent in constructing and maintaining it since 1905. In the last six years alone, the total freight on the canal has been only 9,842,884 tons while the salaries, maintenance and operation paid out by the state in the same period have been $18,446,077 or more than $1.87 for every ton moved, not including the interest on the $12,651,000 spent in the same period on new construction and permanent betterments, the total of which is now in excess of $170,000,000.

As proof of the adage that "Difference of opinion makes horse races," we quote a national figure in political life, who says:

"If our competitive system be the right system, and our Government therefor maintained by taxes, why have any tax-exempt securities at all? The best solution of the tax problem, in my opinion, is in government ownership and management of all industries."

Of similar import is the opinion of an economist who thinks that there is no encroachment of government in business, and that all these matters are simply the experimental ebb and flow of national life.

Another says that private industry is shouting from fear, and that economic laws will cure competition. This, it might be pointed out, would be more surely the case, if governmental operation had the same overhead and depreciation items to consider, that private business must take into consideration.

In conclusion we quote a retired man of affairs who feels that the trouble today is too many men who are ardent capitalists and individualists when their own property or business is concerned. It should be axiomatic among business men and property owners that no single business or industry can be lifted out of the mass of privately conducted enterprise, endowed with the attributes of sovereignty and subsidized by taxation without every other industry and business feeling the baneful effects of such a procedure.

PLAN FOR REHABILITATION OF HYDRAULIC MINING

(*Continued from page* 820)

in practically the same form again at the first opportunity.

General Remarks

The principal opposition to the Cloudman bill and to any thought favoring a resumption of hydraulic mining comes from the people of the Yuba and Sutter County low lands. Their districts suffered the most from the effects of the unrestricted hydraulic mining of the early days, and the memory still rankles of the long and bitter fight before the mines were finally shut down.

It does not seem possible, however, that they will persist in their opposition if they will carefully study the present proposed plan, and especially its details as to the Yuba River, in which they are most interested.

Let me conclude this paper with a short summary of the most outstanding results, as I see them, to be expected from a resumption of restricted hydraulic mining, and show how it ties in with the best interest of every phase of development of the Sacramento Valley.

1. The employment of many men and the expenditure of the large sums of money necessary for the construction of the dams, flumes, and ditches, bedrock tunnels, and for the re-equipping of the mines will immediately and directly benefit merchants, farmers, manufacturers, transportation and power companies, and in fact everyone, for a period of several years. Thereafter for many years the operation of the mines and their gold production would insure prosperity for a large section of the State.

2. The farmers immediately will be benefited directly by the new market for their products, and by provision of permanent diversion facilities for irrigation water from the present natural flow of the streams, later on to be augmented in summer months as flood waters stored for mining purposes are released; indirectly by the improvement in stream and flood control.

3. Electric power production will be increased in low cost plants close to the load center, especially later on when water stored in hydraulic mine pits can be used to replace steam plant units in low-water summer months.

4. The impounding of both natural and mining débris behind the dams will result in increased scouring out of the stream channels below, and will have a very large and beneficial effect in the working out of present stream and flood control problems.

MINING EXHIBIT AT UTAH FAIR SUCCESSFUL

For the first time in the history of the Utah State Fair a comprehensive mines and minerals exhibit was a notable part of the forty-ninth state fair held during the week of October 1. A. G. Mackenzie, member of the state fair board and secretary of the Utah Chapter of the American Mining Congress, was in charge of the mines and minerals exhibit.

The exhibit of minerals included not only the metals, coal, and oil but also the nonmetallic minerals, such as clays, cement and plaster material, salt, building stone—in fact, all of the commercial minerals to be found in Utah.

Models of mines and of mills were used to illustrate to the laymen the progress made in mining and metallurgy in recent years.

THE NATION'S VIEWPOINT

A Digest Of The Expressed Opinions Of Leaders In American Affairs

FEAR of overproduction is the basis of most restrictive legislation is the belief of *Iron and Coal Trades Review*, which editorially points out that:

"Fear of overproduction is at the back of nearly all restricted movements, whether they are called tariffs or trusts or trade-union rules. Something is clearly wrong with the economic structure of the civilized world when we have so many elementary needs unsupplied and so many willing workers whose labor appears not to be wanted at the moment. The demand is certainly there but it is not what economists call an 'effective demand,' that is to say there are men wanting goods and services which existing organizations are ready to supply, but they have not the power to buy. In reality, the power to buy is created by the power to produce, for all trade is an exchange of goods and services, money being merely the counters or tokens used to facilitate the exchange.

"Behind all these, restriction lies in the belief that control, of one kind or another, is necessary in order to prevent the supply outrunning the demand. In reality supply and demand react upon one another; you can not check one without checking the other, though the effects of your restrictive action may not be visible at the moment. It is this time lag that seems to justify a restrictive policy. People can see that if there are more buyers than sellers in a particular market, business will be brisk and prices good; they do not see so clearly that the buyers in their market are the sellers in some other market, otherwise they would not have the wherewithal to buy. Nearly every country appears to have a productive capacity far beyond its consuming capacity; therefore every frontier is guarded by customs-house officials with instructions to keep out foreign goods. Many countries carry this principle too far, failing to recognize that one can not sell without buying. It is clear that science, which has done so much to increase productive capacity, has not been applied too successfully to distribution.

San Francisco Chronicle
Home Again

"John P. Bibby, in a letter to 'The Times' (London) blames the trade unions for the terrible amount of unemployment from which Great Britain has been suffering during recent years. Starting with the sound principle that, under the law of supply and demand, the price of an article begins to fall when the supply exceeds the demand, and vice versa, he declares that 'the attempt to impede the operation of this economic law by labor unions in respect to human labor has inevitably resulted in the present unemployment problem and the consequent reduction in the standard of living for the wage-earning community.' If the law had been allowed to operate, wages would have dropped until the available labor had been drawn into employment, and the nation would have been richer by the product of a million extra workers. Now the standard of living does not depend on money wages, except to the small extent that changes in the value of money alter the distribution of the national income between one class and another; it depends on the amount of wealth, i. e., of goods and services, produced in this country during the year. If the production of wealth increases, the standard of living must rise; if it is decreased the standard must fall; money wages have very little to do with it. Trade union restrictions apply, moreover, to a great many things besides money wages, but for the most part they have the same effect in restricting the production of wealth, and therefore lower the standard of living.

"On the constructive side Mr. Bibby is less convincing than on the critical side. He thinks that the problem of how the operation of the law of supply and demand can safely be assisted must be left to the employers, labor leaders, and the Government. Why drag in the Government? Again, we do not like the proposal to secure an undertaking from the trade union leaders that all wages shall fall as the cost of living falls, and then to 'reduce the cost of living by means of a Government subsidy to the nation's wage bill.' Surely, after recent experience of its futility, a subsidy in aid of wages must be ruled out absolutely."

In a debate with William Green, President of the American Federation of Labor, **Walter Gordon Merritt** summed up the rights of organization, in the following interesting manner:

"If one may judge from utterances by officials of the American Federation of Labor, the criticism of the law in respect to labor unions is not so much directed against the injunction as a particular type of remedy as against the substantive law which declares unlawful certain activities which some labor unions believe should be lawful. This criticism raises an important social question as to the policy to be adopted in respect to powerful organizations of capital or of labor.

"Trade organizations, through the unification of the aggregate resources of their membership, exercise a power for good or ill far transcending the power of individuals. Accordingly, in this country it has been deemed for

©Kansas City Times

Giving the Pedestrian the Right of Way

WITH THIS AXE AN' THAT CAN OF DYNAMITE I MAY GET QUITE A BIT OF KINDLING WOOD!
NEXT SESSION OF CONGRESS
ALL OF US
USUAL CHARGES FOR TAX REDUCTION
1928 ELECTION
10-7
GWS HALL

Arkansas Democrat

Something is Likely to Happen

the common good that such power should be so regulated as not to permit them to overrun industrial liberties of individuals or non-conformists.

"'Industrial liberty' in the United States is a concept of fuller content and broader meaning than in any other country of the world, because our courts more fully protect the industrial rights of employers and employes. This concept protects the rights of workers or employers to organize. It also protects their right to remain unorganized. It implies the condemnation of all schemes which seek to force an employer to join a trust or combination under threat of having his business destroyed or which seek to force a worker into the union under threat of being deprived of his livelihood.

"Society believes that it has a right to buy whatever products it desires to buy, to deal with any employer with whom it desires to deal and to be served by any person who desires to work. It believes that if the laws of the land keep open the door of opportunity so that all employers may, without obstruction, send their merchandise into the markets of the nation and so that all workmen may be free to work at their trade—so that no person and no merchandise is made a commercial leper—the competition thus preserved becomes a regulator of prices in lieu of statutory regulation. It believes that such protection of individual liberty broadens the scope of individual self-government and true democracy.

"All organizations which function in our commercial life must justify their existence by service and not by force. If we permit them to crush rivals and to force society to deal with them or through them notwithstanding how reprehensible their conduct may be, we set force above service and suspend the laws of reward and punishment—the incentives for well-doing. To protect society against such a condition, we must enforce the liberty laws of industry and secure unto all the right to venture. Industrial lockstep does not spell progress."

The Oregonian, published at Portland, Oreg., recently commented upon the series of articles that have appeared in THE MINING CONGRESS JOURNAL, in regard to the Public Lands question. In a strong editorial on "States' Rights in Public Lands," they say:

"The demand that public land, reserved or not, be transferred by Federal Government to the states has moved Colonel W. B. Greeley, chief of the Forest Service, to come to defense of Federal power with an article in THE MINING CONGRESS JOURNAL, but with special reference to the national forests. He does not attempt to answer the argument, by which it is maintained that Federal administration subordinates the West to the East and violates the principle of equality among the states that is in the constitution and in the treaties by which new territory was required. He flatly denies these facts and says: 'The question for the public is whether national forests are good or bad.'

"There is no longer serious dispute of the principle that timber should be protected and grown in public forests; the question is whether these should be national or state. Colonel Greeley goes back three-quarters of a century for facts to support Federal control. He says that by an act of 1850 Congress gave 63,000,000 acres of swamp and overflowed lands to the Southern states, and he says 'the states did not carry out their promises to construct levees and drains' and that the timber lands of Florida passed to timber companies and have been cut over. But the national forests are in the West and were established after vast forest areas had passed into private ownership under the homestead and the timber and stone laws. Congress passed the latter law in order that settlers on prairie land might acquire timber for building, fences and fuel, but it applied that law equally to the densely timbered areas of the West, permitting a settler to acquire 160 acres as a homestead and another 160 acres as a timber claim though his intention was to sell both for the timber. Timber in the early period of

Philadelphia Public Ledger

He'll Have to Whip Behind

Washington Evening Star

October 12, 1927

settlement was a terrible hindrance to the farmer of this region, and his first task was to clear the land, that is, destroy the timber.

"In holding the Western states and their settlers responsible for the destruction and waste of timber during the period between 1850 and adoption of the conservation policy, Colonel Greeley does injustice to the West. During that period the mind of the nation was intent on settlement of the West with farmers and miners, and they were given freedom to destroy such timber as was in their way and to use such as they needed. In the East, South and Middle West as well as in the far West timber was held of small value unless easily accessible to transportation routes, rail or water, to centers of population, and if remote had no value.

"Congress ignorantly passed laws that encouraged destruction in what has become the nation's last great stand of timber. While this was in progress the forest lands of New England, the Allegheny mountains, the lake states and the South were being denuded. When the people of those regions had destroyed their forests, they began to berate the Western people for following their bad example. They called for conservation and these prodigals have the audacity to say to the West: 'We will have Uncle Sam administer your forests. You do not know how.' That is the plain interpretation of these words of Colonel Greeley:

"'The public land states can not take over the management of the national forests. They are not equipped to do so.'

"Fire patrol of the states and the timbermen of Oregon and Washington are certainly a match in efficiency for the Federal forest service. Artificial reforestation on an increasing scale is practiced by the big timbermen in the fir forests of Oregon and Washington, the red-wood forests of California, and the yellow pine forests of the South. Graduates in forestry are turned out in growing numbers from the Oregon Agricultural College and the University of Washington who apply their knowledge by practice in the forests of America, and are not befuddled with the practices of Europe, as are graduates of Eastern colleges whom the forest service sends West. The West is well equipped to manage the forests, and it would not load them with excessive overhead for an office force when the real work must be done in the woods by men who know the woods by daily contact.

"But whether or not the states are equipped to manage the forests, they have the right to do so, well or ill, as equals with the states that have destroyed theirs. The foundation of the states' right was well stated by Representative Winter of Wyoming, when he said at Lander:

"'It is manifest that there can not be complete and equal sovereignty, as was provided in the international treaties and the constitution, unless ultimately, if not upon admission, the power of the Federal Government over the land that comprises the state ceases and that of the state in jurisdiction, authority and taxation completely attaches.'

"The right of the states thus asserted is fundamental, for it arises from the constitutional principle that this nation is a Federal union of equal, sovereign states. Discussion of the comparative competence of nation and states to manage the forests is totally irrelevant."

The Reno, Nev., *State Journal*, in commenting upon the recent articles in THE MINING CONGRESS JOURNAL concerning the Public Lands question, editorially says:

"Public Land Ownership is the title of an interesting article published in a recent issue of THE MINING CONGRESS JOURNAL. The discussion sets forth the fact that in the states of Nevada, Utah, Arizona, Idaho and New Mexico, the Federal Government is owner of from one-half to seven-eighths of the land area included in their borders. The taxable areas of these commonwealths must police the whole state, maintain roads and incur other necessary expenditures on account of a vast domain which they neither own nor control. While there are eleven states in which there remain certain amounts of public land, the states of Nevada and Utah are the two which suffer most from the present public land policies of the Federal Government. In 1836 there was some $28,000,000 surplus in the United States Treasury from public land sales, which was divided among the 26 states then comprising the Union. This was termed a 'loan,' of which not one cent in principal nor interest has ever been repaid. The sum is still carried on the books of the United States Treasury, charged against the various states as 'unavailable funds.' It appears that no demand for these 'loan' funds has ever been made on the favored beneficiaries, and representatives of such states have often been first and foremost in backing the United States

forest service policy of commercialization of the public range in Nevada and elsewhere. There is a certain inconsistency in the views of some of these Congressmen, many of whom are strongly opposed to the Government entering the power business through construction of the Boulder Canyon dam project. Almost in the same breath they demand that the Government embark further in the real estate business through renting the public range lands at the maximum amount which can be extracted from the stockman who has to use them. The problem will not necessarily be solved by deeding the public domain to the commonwealths in which they are situated. Probably the most fair and satisfactory arrangement for the states affected will be to have made a compensatory appropriation from the Federal Government to cover the necessary proportionate cost of road maintenance and police service, together with a recognition of the theory of vested range rights. Such a Federal policy, if adopted, would eliminate the pernicious theory of charging the stockman all the traffic will bear in the form of range fees to the forest service."

The Grand Junction, Colo., *Sentinel*, while uncertain as to just what steps should be taken to relieve the West of its Public Lands question believes firmly that something must be done to relieve the situation. They say:

"Whether it would be better for the great areas of public lands in Colorado and other Western states now held by the Government to pass into private ownership is perhaps an old question, but it is receiving renewed agitation just now by The American Mining Congress. Through its journal, this organization has secured an expression of opinion from hundreds of citizens throughout the West and the Congress declares that the sentiment for private ownership is overwhelming. In all, there are about 400,000,000 acres being held by Federal ownership which, if placed in private hands, would be developed to the benefit not only of the owners but of the country and would become taxable property.

"The Sentinel is not certain just which class of ownership really is the best for the West; but, unless there is a decided change in the manner in which the Government holds and controls the public lands, those who advocate private ownership certainly have the best of the argument."

Christian Science Monitor

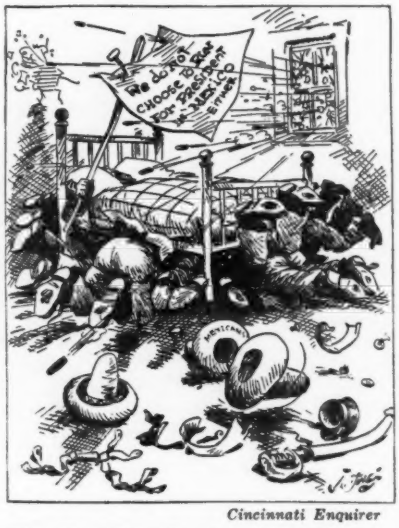
A Once Famous Star Scans the Cast for 1928

An argument in favor of the open shop in American industry is advanced by **Dr. Charles Aubrey Eaton**, who summarizes his views, as follows. *The Industrial Digest*, reprints "The Open Shop—A Moral Issue," in editorial form:

"There is only one way that the working man can permanently succeed, and that is to produce sufficiently to entitle him to a larger share in the wealth of the community. There is only one way that any man is entitled, justly, to a reward, and that is for service rendered. And we must abandon mass action as a destructive force and substitute for it something that will make it possible to solve our problems by cooperation, by discussion, and by peaceful methods. * * *

"Personally I am for the open shop and against the closed shop. My reasons for this position are not merely economic or moral, though I believe the closed shop is bad economically and worse morally. I am opposed to the closed shop primarily on American grounds. Our constitution guarantees every man the right to life, liberty and pursuit of happiness. The closed shop denies the citizen this right and is therefore a plain violation of our fundamental law. Whenever a private organization arrogates to itself a greater authority over the individual than that exercised by the Constitution of the United States, that private organization places itself above and outside the law and becomes a social menace. The closed shop in principle constitutes a monopoly, and in other departments of life would be classed as a conspiracy in restraint of trade.

"I am for the open shop in religion, in thought and in speech, in politics, in banking, in business, in every human relation. I am for the open shop among employers as well as employes. I would give the small man in business protection from the brutality of big interests just as I would give the individual worker protection from enforced control by any labor organization.



Cincinnati Enquirer

Why Good Men Don't go Into Politics in Mexico

The progress of standardization, sponsored by the trade association bodies, has been rapid, and that the work has been extremely helpful to industry is pointed out in a recent editorial in *Iron Trade Review*, which in commenting upon the Machine Tool Congress, said:

"Standardization, that trend which is marking the development of American industry, was stimulated considerably in the sessions of the first Machine Tool Congress held in Cleveland recently. Realizing that multiplicity of sizes, styles, fixtures, etc., is a costly luxury indulged in by manufacturers to create and maintain a prideful identity, the machine tool builders attending the congress opened wide the subject of standardization.

"Benefits of almost incalculable value obtained by the automotive industry through interchangeability of parts, making possible the assembly line method of production and its resultant economies, were held up to the machine tool industry as demonstrating the possibilities of profits in standardization. The basic secret of our national railroad transportation system is standardization. Uniformity in track gage and a definite specification for car couplings make possible the interchange of rolling stock without which our railroads would be operated as a group of individual carriers and not as a homogeneous and comprehensive system.

SLIME FILLING FOR FIRES

(*Continued from page* 834)

ally westward, there would have been even greater vertical range of continuous stoping ground.

With but few exceptions, this ground was top sliced—a very difficult country in which to put out a fire, because of the large amount of timber with no filling, except what had caved from the walls and because of the difficulty of access to the mined areas.

Fortunately, the ore mined from this area did not have a high sulphur content, so the low grade material left after mining did not serve as a spreader of the fire.

Order of Filling

The slimes were first introduced on the 1,800 level over the tops of the bulkheads. This area was filled and allowed to settle so that the bulkheads would not have to stand any great pressure.

The 1,700 was the next point of introduction. During the course of this operation, a line was put up the raise mentioned in the introduction and slimes were put in from the intermediate level (60 ft. up). This latter work was done a little too fast, so that some pressure developed on the bulkheads.

After the 1,700 level sliming, the next point was from the 1,600 level. A small amount of slimes were put in from the 1,400 level, but the amount is not determinable, so in the discussion further on of the completeness of filling, from 1,800 to 1,600 only is considered.

Size of Material

All material used for filling consisted of tailings from the flotation machines which had been partially dewatered or thickened in a settling tank. The material delivered to the mine averaged about 31 percent solids by weight and had approximately the following screen analysis:

	Mesh	Percent	Accumulative Percent
Retained on	48	0.7	0.7
Retained on	65	2.7	3.4
Retained on	100	9.4	12.8
Retained on	150	11.7	24.5
Retained on	200	5.7	30.2
Retained on	—200	69.8	100.0

Hours Run—Tons of Solids

Between the first of October, 1926, and the stopping of operations early in 1927, slimes were run for 1,040 hours, giving an estimated tonnage of 13,000 tons of solids.

Signals

An electric signal system was installed between the mill and the mine, so arranged as to blow a whistle at the mill and to flash an electric light underground. All signals were repeated from receiver to sender. The following code was used:

2-2 Start pumping slimes.
3-3 Stop temporarily.
1-6 Stop pumping slimes.

Overflow

One of the greatest difficulties encountered was that of holding the slimes within the bulkheaded area, particularly in blocking off the raises already through from the 1,900 level to the 1,800 level. One raise (19-42-2), which was run close to the hanging wall of the vein, gave the greatest trouble. The ground between the raise and the hanging wall was well fractured and three attempts were made to seal this raise before being successful. Slimes find their way into very small openings and badly shattered ground presents a problem requiring considerable ingenuity at times.

Slimes escaped from the raise mentioned above and found their way from the 1,800 to the 2,000 level. Sufficient solids remained in suspension to be noted at the 1,200 level pumps. No serious damage was done, but had a large quantity broken through at any one time, the damage would have been serious. This illustrates the necessity of taking great care to prevent the escape of slimes, particularly in a mine like the Old Dominion where the water problem is at all times serious.

Fortunately, the acidity of the overflow water was never high. This is probably due in part to the fact that the mill water has a high alkakinity; however, had there been much burning sulphides, this could have had but little effect. The fire must have been almost wholly a timber fire with but little sulphide in contact with it.

Costs

The cost of installing and operating the slime line from September 1, 1926, to January 31, 1927, is shown in the following table:

Installing slime line:		
Labor	$1,851.28	
Supplies	5,075.09	
		$6,926.37
Operating slime line:		
Labor	$5,754.96	
Supplies	5,075.09	
Drills	144.56	
Timber	457.32	
		8,172.76
Total		$15,099.13

Conclusions

In an operation of this kind it is practically impossible to draw definite conclusions. Most of them have to be made by inference.

The only places re-opened are on the 1,800 level. These show complete filling of the drifts. It is probable then that the base of the area is completely slimed. The amount of material put in was 13,000 tons of solids, which is enough to fill only part of the total area. There is no way of getting even a reasonably accurate figure as to the percentage of voids in the old caved vein. Considering that there are 20 percent voids, it would take a minimum of 30,000 tons of solids (slimes at 20 cu. ft. per ton) to completely fill the area in question (1,800-1,600 Blocks 36-44). This figure is probably too low, but no figure of any accuracy is obtainable.

There has been no gas issuing from the fire country for some time. If the fire were burning, gas would be discovered either at the Kingdon shaft or at the "A" shaft, the only two upcast shafts in the mine.

Other's experience with sliming would indicate that one should not be too sure that the fire is completely extinguished, all present evidence to the contrary. It is improbable that the Old Dominion will ever open up any of the fire country except on the 1,800 level. This work will be just enough to permit connections with the 1,900 on the vein in order to resume stoping. Until stoping is restarted and the country above starts moving again, the fire, if not extinguished, will probably remain quiescent. A resumption of top slicing will again give access of air to the country above. Then and not until then shall we be able to definitely and finally say—"The fire is out."

NEW TOPOGRAPHIC MAP OF AREA IN PENNSYLVANIA

THE recent issue by the Geological Survey of the map of the Lewistown quadrangle in central Pennsylvania brings the mapped portion of the state up to 76½ percent of the total area. This achievement is believed to be worthy of note, for a topographic map is no common or usual map, costing perhaps a few hundred dollars, but is a comprehensive picture of the area it represents, and it costs several thousand dollars to survey and publish each sheet. The field surveys and preparation for publication of the Lewistown map alone, which covers only 228 square miles, cost over $7,000. In addition to the usual features shown on any good map, such as rivers and lakes, cities, towns, roads, railroads, and bridges, a topographic map contains thousands of contour lines, which indicate horizontal lines of altitude above sea level. The contouring is the feature that increases the cost of the field surveys to such a degree as to make a topographic map the most expensive of all maps, as it is the most valuable. It is a base or master map, and where a topographic map is available for any area there is seldom need for additional surveys of that area for engineering projects. The topographic maps of the Geological Survey are used as bases for hundreds of different kinds of activities, both governmental and private.

Surveys to be Completed in 10 Years

The unmapped portion of Pennsylvania, some 10,600 square miles in area, is being surveyed as rapidly as available funds will permit. The work is being done by the Federal Geological Survey in cooperation with the state geologist under the Pennsylvania Department of Internal Affairs, the United States and the state governments each contributing half of the cost. At the present rate of progress with about 900 square miles surveyed annually, the remaining unmapped 23½ percent of Pennsylvania should be completed in about 10 years. The topographic mapping of New York State under similar cooperative arrangements has just been completed by the Geological Survey, New York being the eighth state in the Union to have a complete topographic map of its entire area.

NEWS OF THE MINING FIELD

A Resume Of The Activities Of The Mining Industry And Items Of Interest In The Field

ARIZONA CHAPTER HOLDS HIGHLY SUCCESSFUL MEETING IN THE GLOBE-MIAMI DISTRICT

THE Arizona Chapter of the American Mining Congress held its fall meeting in the Globe-Miami district on October 10 and 11. One hundred and twenty men, including mine operators from every important district in the state and some from outside of the state, were in attendance at the sessions.

The meeting was opened on Monday morning, the 10th, with a session at the Old Dominion Library at which papers on some of the major operating problems of the district were presented. These papers were as follows:

"History of the Development of the Undercut Caving Method of Mining," by Felix McDonald, mine superintendent and J. L. Johnson, assistant mine superintendent, Inspiration Consolidated Copper Co.

"Engineering Features of the Undercut Caving System of Mining as applied at the Miami Copper Co.," by A. J. McDermid, development engineer, Miami Copper Co.

"Slime Filling for Extinguishing Mine Fires," by H. S. Duncan, chief mine engineer, and A. H. Shoemaker, geologist, Old Dominion Co.

"Retreatment of Concentrates at the Miami Copper Co.," by H. D. Hunt, mill superintendent, Miami Copper Co.

"The Inspiration Leaching Plant," by H. W. Aldrich, superintendent of Leaching Plant, Inspiration Consolidated Copper Co.

"Reverberatory Practice at Magma," by J. H. Rose, smelter superintendent, Magma Copper Co.

The great interest aroused by these papers was clearly shown by the active discussion following the presentation of each paper. The papers will be printed in full in this and the following issue of THE MINING CONGRESS JOURNAL.

On Monday afternoon the visitors were taken on a tour of the entire district. Stops were made at the caves over the mining operations at the Inspiration and Miami mines.

On Monday evening a banquet was held for the visitors at the Cobre Valle Country Club. Doctor Bacon, chief surgeon for the Miami and Inspiration companies acted as toastmaster and responses were made by F. W. McLennan, J. P. Hodgson, H. A. Clark, E. P. Mathewson and W. V. DeCamp. High tribute was paid to Felix McDonald as the originator of the undercut caving method of mining and to the operators of the Miami and Inspiration mines for the modifications of this method that have brought it to the present high state of efficiency. Entertainment was furnished by the Francis Gilbert Orchestra, the Elk's Quartet of Globe, and by a company of four entertainers from Phoenix.

On the following day special inspection trips were made to the mines, mills, power plants and smelter. Guests had a selection of any one of nine separate inspection trips in the district. At the invitation of the management of the Magma Copper Co., many of the visitors made the trip to Superior to visit the mine and plant of that company on the third day.

On Tuesday the directors of the Arizona Chapter were guests of the Globe Luncheon Club at their regular monthly luncheon which was given over to a discussion of the progress made in the development of methods that permitted the mining of low grade ores that a few years ago were of no value.

All visitors in the district expressed most enthusiastic appreciation of the excellent program arranged for the meeting and the many courtesies extended by the operating staffs of the mining companies of the district.

C. F. Dike Heads Tri-State Producers

C. F. Dike, of Joplin, Mo., manager of the Interstate Zinc and Lead Corporation, was elected president of the Tri-State Zinc and Lead Ore Producers' Association, at a meeting of the board of directors held at Picher, Okla., October 14. Mr. Dike succeeds J. F. Robinson, of Miami, who has held the office three years, or since the formation of the organization.

Sidney H. Davis, Baxter Springs, was elected first vice president, filling the place previously held by Mr. Dike. M. F. Owens, manager of the Black Eagle Mining Company, was elected second vice president.

Charles A. Neal, Miami, was elected treasurer to succeed George A. Pearson.

Mr. Robinson and Frank Childress were elected to the executive committee, which consists of five members, the other three being the president and two vice presidents.

MINE PRODUCTION OF GOLD, SILVER, COPPER, LEAD, AND ZINC IN NEVADA IN 1926, BY COUNTIES

(In terms of recovered or recoverable metal)

Advance figures by V. C. Heikes, of the United States Bureau of Mines

County	No. of producers	Ore treated Short tons	Gold * Fine ounces	Silver * Fine ounces	Copper Pounds	Lead Pounds	Zinc Pounds	Total value
Churchill	8	896	210.43	27,490	1,453	447,788	.....	$57,530
Clark	36	13,025	3,275.86	39,121	21,240	2,044,599	2,210,162	424,434
Douglas	5	64	16.84	1,640	51	19,735	.....	2,957
Elko	35	64,725	25,145.23	194,235	276,239	3,231,460	18,527	939,581
Esmeralda	37	34,130	8,894.76	524,188	3,115	70,834	.....	517,067
Eureka	19	34,968	3,921.28	155,425	67,359	5,653,705	39,097	642,703
Humboldt	17	413	126.50	7,749	30	24,445	.....	9,410
Lander	29	75,349	2,769.81	1,125,572	241,271	465,237	1,318	830,710
Lincoln	12	69,096	1,019.07	427,345	642,047	6,188,550	7,517,040	1,436,478
Lyon	14	248,538	1,599.66	43,567	5 457,347	.....	.....	824,283
Mineral	41	40,410	1,748.61	287,696	57,054	1,693,400	910,125	427,387
Nye	60	138,784	31,670.77	1,941,406	17,271	761,682	.....	1,929,482
Ormsby	1	1	1.31	2	.....	.....	.....	28
Pershing	30	1,341	675.41	20,643	4,245	215,995	.....	44,717
Storey	18	481,767	57,144.28	1,534,116	3,390	.....	.....	2,139,041
Washoe	13	560	701.53	21,818	3,840	56,517	69,661	38,401
White Pine	30	4,680,501	36,460.33	166,970	95,031,985	1,494,018	51,900	14,285,782
Total, 1926	405	5,884,568	175,381.68	6,518,983	101,827,937	22,367,965	10,817,833	†24,549,991
Total, 1925	424	4,927,139	187,104.72	7,096,618	79,300,224	24,476,452	14,821,296	‡23,309,352

* Includes placer production. † Average value of metals: Gold, $20.671835 per ounce; silver, $0.624 per ounce; copper, $0.14 per pound; lead, $0.08 per pound; zinc, $0.075 per pound. ‡ Average value of metals: Gold, $20.671835 per ounce; silver, $0.694 per ounce; copper, $0.142 per pound; lead, $0.087 per pound; zinc, $0.076 per pound.

Consolidated Virginia Enters New Mining Field

The Consolidated Virginia Mining Company of Nevada has taken over the Ord group of 28 mining claims, 8 of which are patented, in the Ord-Belleville district in San Bernardino County, California, 14 miles south of Daggett; the intention being to shortly begin operation of this copper-gold mine.

Gordon Cole, mining engineer, will be in charge of Ord mine development and operation, and equipment is to be sent to the mine at once, while the construction of a large milling plant is one of the possibilities of the near future.

Associated with the Consolidated Virginia in this deal is the Ophir Mining Company and the Mexican Gold & Silver Mining Company, all of Virginia City, Nev., the latter being the owner of the rich Mexican mine in Inyo County, Calif.

Shattuck-Denn Development Work

Actual development work on the 2,000-ft. level of the Denn shaft of the Shattuck-Denn Mining Corporation in the Warren District, Arizona, was started October 3, when contractors began driving drifts to explore the surrounding territory for ore which upper level indications lead officials to believe exists in paying quantities. Drifts will lead off from the 2,000-ft. level in several directions and exploration work will not be halted until definite results have been obtained.

Drifting between the 1,400 and 1,800-ft. levels also is being carried on at the present time.

Remodeling Plans Completed for Humboldt Concentrator

The Phelps Dodge Corporation has completed its plans for the rebuilding and repairing of the concentrator of the Southwest Metals Company at Humboldt, Ariz., held under lease. The entire equipment from the bins to the tailings dump will be placed in first-class condition. In the flotation department all equipment will be junked and replaced by new cells and filters, thickeners, and conveyors.

This plant is being rebuilt to handle complex copper-lead-zinc ores, which are prevalent in Yavapai and Mohave Counties of Arizona.

Ore is being stocked at the present time and it is hoped to have between 5,000 and 6,000 tons on hand before the concentrator is started. The plant will probably be operated on a 150-ton daily basis.

COPPER & BRASS RESEARCH ASSOCIATION

At the seventh annual meeting of the Copper & Brass Research Association held at its offices in New York City, R. L. Agassiz, chairman of the Calumet & Hecla Consolidated Copper Co., was reelected president. William A. Willis, who has managed the association since its formation, was reelected to that position.

The following were elected members of the Board of Directors, the first nine comprising the Executive Committee:

R. L. Agassiz, chairman, Calumet & Hecla Consolidated Copper Co.; Walter Douglas, president, Phelps Dodge Corporation; C. F. Kelley, president, Anaconda Copper Mining Co.; Stephen Birch, president, Kennecott Copper Corporation; Charles Hayden, vice president, Nevada Consolidated Copper Co., Ray Consolidated Copper Co., Utah Copper Co.; John A. Coe, president, The American Brass Co.; F. S. Chase, president, Chase Brass & Copper Co., Inc.; Edward H. Binns, president, C. G. Hussey & Co.; Barton Haselton, president and general manager, Rome Brass & Copper Co.

J. W. Allen, treasurer, Greene Cananea Copper Co., Inspiration Consolidated Copper Co.; Charles F. Ayer, president, Magma Copper Co.; Francis J. Bassett, sales manager, Taunton-New Bedford Copper Co.; Julian B. Beaty, vice president, Nichols Copper Co.; H. C. Bellinger, vice president, Chile Exploration Co.; J. C. Clendenin, director, Braden Copper Co.; Carl F. Dietz, president, Bridgeport Brass Co.; B. Goldsmith, president, The National Brass & Copper Co.; E. O. Goss, president, Scovill Manufacturing Co.; C. V. Jenkins, treasurer, Utah Copper Co.; William Loeb, vice president, American Smelting & Refining Co.; H. B. Paull, auditor, Calumet & Arizona Mining Co., New Cornelia Copper Co.; Dr. R. M. Raymond, director, United Verde Extension Mining Co.; Sam A. Lewisohn, vice pres. and treas., Miami Copper Co.; C. M. Loeb, president, American Metal Co., Ltd.; Charles W. Clark, president, United Verde Copper Co.

At a meeting of the Board of Directors the following officers were elected: President, R. L. Agassiz; vice presidents, C. F. Kelley, F. S. Chase, Walter Douglas, Barton Haselton; treasurer, Stephen Birch.

H. H. R. Spofford was reelected secretary.

The following companies now comprise the membership of the association:

COPPER MINING, SMELTING AND REFINING COMPANIES

The American Metal Co., Ltd., American Smelting & Refining Co., Anaconda Copper Mining Co., Arizona Commercial Mining Co., Braden Copper Co., Calumet & Arizona Mining Co., Calumet & Hecla Consolidated Copper Co., Chile Exploration Co., Greene Cananea Copper Co., Inspiration Consolidated Copper Co., Isle Royale Copper Co., Kennecott Copper Corporation, Magma Copper Co., Miami Copper Co., Mother Lode Coalition Mines Co., Nevada Consolidated Copper Co., New Cornelia Copper Co., Nichols Copper Co., Old Dominion Co., Phelps Dodge Corporation, Ray Consolidated Copper Co., Shattuck Denn Mining Corporation, United Verde Copper Co., United Verde Extension Mining Co., Utah Copper Co., White Pine Copper Co.

COPPER & BRASS FABRICATING & DISTRIBUTING COMPANIES

The American Brass Co., Bridgeport Brass Company, Chase Brass & Copper Co., Inc., T. E. Conklin Brass & Copper Co., Dallas Brass & Copper Co., C. G. Hussey & Co., Mueller Co., The National Brass & Copper Co., New England Brass Co., New Haven Copper Co., New Jersey Wire Cloth Co., The Paper & Textile Machinery Co., The J. M. & L. A. Osborn Co., Rome Brass & Copper Co., Scoville Manufacturing Co., Taunton-New Bedford Copper Co., The Foster-Wheeler Co., Wolverine Tube Co.

Arizona Metals Operating Test Plant

A small test plant is being operated successfully at the property of the Arizona Metals Company, Kirkland, Ariz. The Arizona Metals has been prospecting the old Zonia property and the French Gulch claims for the last year and has made a thorough study of the leaching plant and methods used by New Cornelia. The test mill consists of a series of vats, the top one being used to mix the water and sulphuric acid, and six smaller vats carrying the solution with which to treat six charges of ore, ground to a No. 3 screen and bedded down in the boxes. Each box is loaded with about 1,500 pounds of ore. The copper in solution is deposited on scrap iron. It is intimated that the Loring-Hammond interests contemplate the erection of a 300-ton plant late this fall. Mining will be by steam shovel.

Lucky Boy Mine Unwatered

The unwatering of the Lucky Boy mine, at Oatman, Ariz., has been completed by the United Verde Copper Company as the first step in the prospecting of the Oatman Eureka mine, held under option. The shaft is being equipped with a 325-cubic-ft. compressor and a 40-horsepower hoist. Crosscutting to the Oatman Eureka vein will be started in a few days. W. J. Flood is in charge.

Drifting at Bisbee Queen

Four drifts are being rushed on the property of the Bisbee Queen Company, a subsidiary of the United Verde Extension, which completed sinking of its three-compartment shaft last month. One drift is being run off the 200-ft. level, another off the 375-ft., one off the 600-ft., and the other off the 800-ft. level. All of the drifts are in mineralized ground, and officials in charge of the work express satisfaction with the results thus far. United Verde Extension will spend a quarter of a million dollars before it completes its development program in the Bisbee district.

Jefferson Mine Leased

The Elsa Mining Company has a lease with option to purchase the Jefferson mine at Round Mountain, Nev. The 150-ton flotation mill built by the Jefferson Gold and Silver Mining Company is being rebuilt and will use a process consisting of cyanidation, roasting, and leaching, which is claimed will recover 95 percent of the values in the ore.

The Goldfield Deep Mines Company, Goldfield, Nev., has unwatered the shaft to the 2,150-ft. level and as soon as six or seven sets of timbers are replaced in the shaft it will be in good working condition. Station pumps on the 2,150 level are working 18 hours a day to handle the volume of water, which is less than when pumping was suspended last May. Crosscuts will be run to the ledge as soon as the repairs are finished.

Fire in Mammoth Mine, Utah

A fire in the Mammoth mine at Tintic, Utah, October 7, caused damage estimated at $75,000 and closed the mine exit to miners who were at work on the 1,500-ft. level. The compressor room, blacksmith shop and machine shop were totally destroyed. The blaze is believed to have started in the gable end of the compressor and boiler room and is thought to have been caused by defective wiring or the ignition of coal dust. The men temporarily imprisoned were rescued about midnight through the Grand Central workings.

MINING EXHIBIT TO BE FEATURE OF ARIZONA STATE FAIR

One of the outstanding attractions to be seen at the Arizona State Fair during the week of November 7th will be a mineral exhibit containing more than 10,000 specimens of ores and minerals. W. J. Graham, of Phoenix, is superintending the arrangements for the mines and minerals exhibit.

The University of Arizona will be represented by Mr. Fansett, who will demonstrate the various simple tests for ores, and by Mr. Wilson, who will describe the various rock textures.

Negotiations have been entered into with the Phelps Dodge Corporation for a working model of their new lead smelter and concentrator. There will also be exhibits of various types of mining machinery.

Coeur d'Alene Mine Dividends

Dividends of Coeur d'Alene mines for the first nine months of this year total $4,192,250, which is an unusually strong showing considering the low price of lead and also the fact that two companies are spending $1,000,000 in building the zinc plant at Kellogg. One new company, the Sunshine, is on the dividend list for the first time. The Sidney also is beginning to pay dividends and both these expect to pay heavier rates next year.

The Bunker Hill & Sullivan Mining & Concentrating Company leads the list of dividends for the three quarters with $2,205,250. The company is one of the two half-interest owners in the Sullivan Mining Company, which is building the zinc plant.

The Hecla Mining Company recently paid its third dividend. The Federal Mining & Smelting Company, which owns the Morning and other mines, has paid during the nine months $500,000 as an extra dividend on its common stock, in addition to its dividend on preferred stock.

Dividends for the year for the district promise to total well above the $5,000,000 mark.

A newly formed company in Tucson, Ariz., has let a contract to sink the main shaft of the old Bonnie property to a depth of 800 ft. from its present level of 500 ft. The Bonnie is 1 mile south of the Eighty-five mine at Valedon, N. Mex., and was one of the earliest copper, silver, and gold producers in that region.

The Reorganized Silver King Divide Mining Company, Reno, Nev., has taken a lease and option on the East Gate and the Sunny Jim lode claims, in southeastern Churchill County, Nev. A camp is being established and work was started on October 1.

Pioneer Shaft Concreted

The Oliver Iron Mining Company has completed concrete work in its Pioneer "A" shaft to the bottom depth of 1,461 ft. Installation of the cage hoist is under way, and a skip hoist will be installed soon. The Pioneer mine is situated at Ely, Minn., on the Vermilion iron range.

Drifting at Geneva Mine

At the Geneva shaft of the Oliver Iron Mining Co., Ironwood, Mich., Gogebic iron range, drifting is in progress from the 30th level of the shaft toward workings in the Davis mine near by. It is expected now that this drift will be completed about the first of next May. A skip hoist for the Geneva shaft has been scheduled for delivery in November and will be installed as rapidly as possible after receipt. Hoisting is done at present with the cage hoist, which has been installed for some time and used for sinking the shaft.

September Iron Ore Shipments

Total shipments by boat of Lake Superior iron ore for the season, through September 30, are 42,387,376 gross tons, comparing with 45,230,908 gross tons shipped by the corresponding date of last year, according to *Skillings' Mining Review*. A direct proportion of shipments for the two years would indicate a total shipment to be expected this year of about 55,000,000 tons. However, it is very probable that the tonnage figures for this year and last will spread more rapidly in October and November than they did in preceding months. Taking these conditions into consideration, it seems hardly probable that there will be forwarded more than 53,000,000 tons of iron ore by lake vessels from iron mines in the Lake Superior region.

Heads Michigan Tech Board

Hon. William Kelly, of Iron Mountain, Mich., was reelected chairman of the board of control of the Michigan College of Mining and Technology at a recent meeting. A. E. Petermann, of Calumet, and Dr. C. T. Ferries, of Houghton, recently appointed to the board by Governor Green, were in attendance. Other members are E. W. Walker, Houghton; A. Mathews, Verona; and F. M. Prescott, Menominee. Mr. Kelly is dean of the board, having been a member for 30 years and chairman for many years.

The board instructed the faculty to prepare the curricula in mechanical, chemical, electrical, and civil engineering, which were provided by the last session of the legislature to broaden the scope of engineering instruction. Heretofore only two years' instruction have been given in these courses.

Record Enrollment at Missouri School of Mines

The enrollment at the School of Mines and Metallurgy of the University of Missouri this year is the largest in the history of the school, with more students already enrolled for this semester than registered for the full year last year. The total enrollment is close to 475. Of these 175 are freshmen, and a total of 234 new students altogether. Twenty-seven states and four foreign countries are represented in the enrollment.

This unusual enrollment comes at a time when the school is most poorly provided for with funds. The appropriations last made for the school were substantially less than had been made for the past two years, although Director Fulton foresaw the probable increase and urged the necessity of providing additional funds. This increased enrollment and decreased appropriation has made it necessary that many members of the faculty carry teaching loads much in excess of those usually carried.

Vulture Mine Ships Bullion

The first consignment of bullion to the U. S. mint has been made by the new management of the old Vulture gold mine at Wickenburg, Ariz. This mine has been idle since 1914 after years of heavy production, but is now reopened to the 600-ft. level, with a considerable tonnage of high-grade gold ore reported on that horizon. It is the intention to sink to the 750-ft. level.

UNDERGROUND POWER STANDARDS

THE American Mining Congress has organized within its National Standardization Division a Committee on Underground Power Transmission and Power Equipment for Metal Mines, with F. L. Stone of the General Electric Company as chairman. It is planned to use the standard on underground power transmission and power equipment previously adopted for coal mines as a guide in compiling rules and regulations for metal mines. The committee will meet in Washington in December at the time of the annual convention of The American Mining Congress.

The other members of this committee are: Allen C. Butterworth, Pickands-Mather & Co., Duluth, Minn.; C. W. Corfield, Utah Copper Co., Garfield, Utah; Carl Fichtel, Calumet and Hecla Cons. Copper Co., Calumet, Mich.; E. W. Fredell, United Verde Copper Co., Jerome, Ariz.; F. W. Gilbert, MacIntyre Porcupine Mines, Ltd., Schumacher, Ontario, Canada; C. H. Matthews and Herbert Speight, Westinghouse Electric and Manufacturing Co., Pittsburgh; F. C. Stanford, Cleveland-Cliffs Iron Co., Ishpeming, Mich.; A. N. Voss, Inspiration Cons. Copper Co., Inspiration, Ariz.; Arvid Wickstrom, of M. A. Hanna & Co., Duluth; and C. D. Woodward, Anaconda Copper Mining Co., Butte, Mont.

Page Mill Handling 250 Tons Daily

The mill at the Page mine of the Federal Mining and Smelting Company, Wallace, Idaho, is handling 250 tons of ore daily and it is expected that the capacity will be increased. The incline shaft in the Page mine is being sunk from a depth of 600 ft. to 900 ft. Laterals have been opened on the 300 and 600 levels and are furnishing mill feed. From a pay roll of about 75 men, when production started a year ago, the force has been increased to 150 men.

BRIEFS FILED IN FLUORSPAR TARIFF CASE

THE Tariff Commission has taken under advisement final briefs in connection with applications which were heard July 22 for increased duties on imported fluorspar. The next step in the case will be submission by the commission of a report on the question to the President, who is authorized under the flexible provision of the tariff law to increase or decrease a duty by not more than 50 percent of the existing duty.

Briefs were filed on behalf of Illinois and Kentucky fluorspar producers in favor of a 50 percent increase in the duty, which is now $5 per ton. Briefs in opposition to increased duties were filed by the U. S. Smelting, Refining and Mining Company, Bethlehem Steel Company, Hazel Atlas Glass Company, and William H. Muller & Company.

In urging a maximum increase in the duty, Illinois and Kentucky fluorspar producers say it would widen the domestic market for their product and permit operation by American producers at a slight profit, or at least without losses they are now suffering. "The industry is in an exceeding precarious condition," says their brief. "Many companies have been forced to discontinue production and others are working half time."

The producers say the increased duty will not add to the price of fluorspar or derange the compensatory duties. It is estimated that an increase in the duty of $2.50 per net ton or $2.80 per long ton would amount to an addition of nine-tenths of 1 cent per ton to the cost of producing steel. The commission is urged to report to the President at the earliest possible date.

In opposing the increase the Bethlehem Steel Company attacks the action of the commission in using invoice prices as a basis of comparing foreign production costs. It states that the domestic cost of production of gravel spar was improperly determined in the preliminary statement of the commission.

Declaration is made by the company that an increase in the duty will not increase the consumption of fluorspar or of prices of domestic spar, but that the burden of the increase will fall on eastern consumers without substantial benefit to domestic fluorspar producers. Reserves of domestic fluorspar, it claimed, may be exhausted in a few years and no action should be taken which would artifically stimulate their exhaustion. The company says it has not been shown that the present duty does not equalize the difference in cost of production in the United States and foreign countries.

The U. S. Smelting, Refining and Mining Company bases its opposition on the effect of the added duty on acid spar used by it in the manufacture of hydrofluoric acid. Instead of an increased duty, the company requests a reclassification of fluorspar in accordance with commercial classes and suggests that the duty on acid spar be reduced by $2.50 per ton. The company says the method of ascertaining costs of production of domestic and imported merchandise for comparative purposes should be uniform, and attacks the invoice price basis of foreign costs as used by the commission in this case.

Argo Mill, Colorado, Being Overhauled

One of the largest mills in Colorado, the Argo mill at the portal of the Newhouse tunnel, Idaho Springs, is being completely overhauled, new process and new machinery being installed, and immediate operation is expected. This mill has been closed for several years.

Royalties totaling $1,307,114.54 have been placed to the credit of 50 Quapaw Indians in Oklahoma by the Bureau of Indian Affairs, Department of the Interior, as their returns on lead and zinc leases.

DEPARTMENT OF COMMERCE COORDINATES MINERALS AND METALS SERVICES

THE United States Department of Commerce has been surveying and coordinating its activities in the field of minerals and metals to the end that these industries may be able to obtain through the department's facilities a broad international perspective.

The first step in rendering more efficient service in this direction has been the formation in the Bureau of Foreign and Domestic Commerce of a minerals division, which will supplement and assist in the work of the Economics Branch of the Bureau of Mines. This division, the nucleus of which is the former minerals section of the Foreign and Domestic Bureau's Iron and Steel Division, comprises three sections; coal, petroleum, and minerals and metals, each in charge of a specialist in these commodities.

The Minerals Division has been charged with the development and promotion of foreign trade in minerals and metals and their primary products and is responsible for the collection, compilation and dissemination of current foreign trade information. Its mineral and metal marketing specialists are the connecting links between these industries and the Bureau of Foreign and Domestic Commerce's sources of information and services throughout the world, including 51 bureau foreign offices and 438 United States Consulates. The bureau's 57 district and cooperative offices in the principal cities of the United States serve to keep the American manufacturer and exporter in more direct touch with the bureau at Washington.

Aided by the department's foreign offices, the specialists and engineers of the Economics Branch of the Bureau of Mines will expand its researches into world-wide mineral occurrences and productions. Its several divisions specializing in coal, petroleum and other minerals, both metallic and nonmetallic, will continue to make studies of the economic problems of the mineral industries of the country and endeavor to aid in their solution. The Economics Branch will likewise carry on its studies and investigations into domestic resources, volume of production, consumption, distribution, stocks, commercial uses, trade conditions and similar subjects, and will continue to collect and disseminate statistical data relating to all of these subjects.

The Bureau of Mines

The Bureau of Mines is, of course, the most important and is undoubtedly the best known to the mining industry. It is the province of this bureau to study the methods of producing, treating and utilizing ores, mineral oils, gases and other mineral substances. The purpose is to reduce or prevent waste in the mining, quarrying, metallurgical, and other mineral industries and to conserve the country's mineral resources. Its specialists in technology make special investigations of the cause and prevention of mine explosions and major mine accidents. Its system of approved electrical devices directs attention to safe machinery for mining purposes. Its metallurgists and groups of 11 experiment stations and 13 field offices in various parts of the country offer service in studying complex ores, the beneficiation of low grade ores, and the elimination of waste in metallurgical processes. The Health and Safety Branch directs a service of instruction in safety methods and mine rescue in case of disaster, through a system of five field offices and 11 well equipped railroad cars carrying specialized apparatus and skilled crews. This is supplemented by a system of 10 fixed stations from which mine rescue trucks give similar service. Its safety specialists investigate safety practices in mines, and offer reports thereon when requested. Its surgeons make special studies of health conditions in mines, and the special health hazards of the mining and metallurgical industries.

The Bureau of Standards

The basic function of the Bureau of Standards is to establish and maintain national standards of quantitative measurement, although substantially half of the resources of this bureau are expended in the testing of materials, instruments and equipment. Its metallurgy division has for its function investigational work with metals and alloys to determine their structure and behavior under various conditions and to establish specifications for standards of metals and alloys and determine their metallurgical constants and properties. It conducts investigations looking to improvement of metallurgical processes, such as annealing, tempering, casting and welding. Its clay and silicate products division makes investigations into the principles involved in the manufacture of clay and silicate products, including tiles, porcelain, glass, cement, etc.; the construction of refractories and the enameling of metals. It determines the formulae and specifications for standard qualities of such materials. Its division

RADIO PROSPECTING EXPERIMENTS

Radio prospecting for minerals holds promise and is being followed closely by mining men of the entire nation, according to Dean F. A. Thompson, of the Idaho School of Mines, who returned recently from viewing experimental operations of the apparatus.

THE prospecting work described is being done near the Old Dominion mine in Stevens County, Wash., where the Argus Research Corporation is engaged in the study of the possible usefulness of radio in ore detection. Dean Thomson particularly is interested in the experiments because two graduates of the Idaho School of Mines, F. Cushing Moors, consulting engineer at Spokane, and the first mine graduate here, and O. A. Huefner, of Kellogg, a 1927 graduate, are associated with the experiment, and to keep in touch with any significant development that promises to open new fields in the mineral industry.

"The preliminary results, although not final or conclusive, are interesting, and promising," said Dr. Thompson. "Briefly, the apparatus consists of a radio sending set, placed at a central point, and a receiving loop mounted on the axis of a transit. The area to be prospected is marked in checkerboard fashion, intersections being 30 feet apart. Vertical and horizontal angles at which the receiving loop indicates minimum reception are plotted at each intersection. By graphing the dip of the radio waves, the metalliferous body is located, for the waves are distorted in the presence of metal."

A limitation to radio prospecting as experimented with now, is that the machine makes no distinction between different metallic sulphides. When the first experiment indicated presence of a mineral body it was found to be barren pyrite. "Much work will be necessary in order to eliminate the interfering effect or disseminated barren sulphides."

of simplified practice aids the various industries to standardize, as far as practicable, the grades, types and sizes of the commodities which they produce for market and the nomenclature applicable thereto, in order to reduce and eliminate wastes which result from excessive variety.

The Bureau of the Census periodically obtains and records special statistics of interest to the minerals industry, such as data pertaining to the country's mines, quarries, refineries, manufacturers, etc.

The Department of Commerce invites the minerals and metals industries to utilize its economic and technologic services to the fullest degree. Industry, however, should take the initiative in making its special needs known to the department.

Illinois Joint Wage Commission Organizes

The Joint Wage Commission of the Coal Operators' Association of Illinois and the United Mine Workers of Illinois, to whom was referred the task of drawing up a wage contract effective April 1, 1928, elected Henry Fishwick, president of the Illinois Miners' Union, as chairman of the commission, and Herman Perry, vice president of the Operators' Association, as secretary at a meeting in Chicago, October 26. The other members of the commission are Rice Miller, president of the Operators' Association, and William Sneed, vice president of District 12, United Mine Workers.

The commission is to report its findings and recommendations to a joint scale meeting to be held in Chicago, February 7, 1928.

Anthracite Industry to Hold Conference

The Pennsylvania anthracite coal industry will hold a cooperative conference at Mt. Carmel, Pa., from November 9 to 11. The conference will bring miners and operators together for the purpose of initiating a movement to regain lost markets and prestige. The meeting will be managed by business men of the anthracite region in northeastern Pennsylvania. Many coal dealers marketing anthracite in the principal consuming sections, will also attend.

Prominent Federal and state officials, besides operators and miners, will attend the meeting. Secretary of Commerce Herbert Hoover, Governor Fisher of Pennsylvania, S. D. Warriner, chairman of the Anthracite Operators' Conference, John L. Lewis, president of the United Mine Workers, Daniel T. Pierce, of New York City, and Thomas Kennedy, secretary of the miners' union, are among those appearing on the program.

Committees are working vigorously to make this convention a success, inasmuch as it is for the ultimate good of the whole industry, from the standpoint of the operators, miners and the public of the anthracite districts.

COAL ENGINEERS DISCUSS MECHANICAL LOADING

A VERY interesting program on Mechanical Loading and Mine Transportation was presented in Pittsburgh, Pa., October 20th, at a joint meeting of the Engineers' Society of Western Pennsylvania and the American Institute of Mining and Metallurgical Engineers. About 300 attended this conference, at which the following program was presented:

MORNING SESSION

Mechanical Loading in the Pittsburgh District, by L. E. Young, production vice president, Pittsburgh Coal Co.

Discussion on this subject by Glenn Southward, The American Mining Congress; W. L. Affelder, asst. to pres., Hillman Coal & Coke Co., and George Osler, vice president, Pittsburgh Terminal Coal Corp.

Conveyor System of the H. C. Frick Coke Co., by T. W. Dawson, chief engineer, H. C. Frick Coke Co., Scottdale, Pa.

AFTERNOON SESSION

Mine Locomotives—Gathering and Main Line Haul, by G. H. Shapter, commercial engineer, General Electric Co., Erie, Pa., and W. A. Clark, general engineer, General Engineering Dept., Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

C. E. Lesher, vice pres. of the Pittsburgh Coal Co., presided at the morning session on Mechanical Loading and Graham Bright, Mines Safety Appliances Co., presided at the afternoon session on Mine Locomotives.

The papers on mechanical loading described a number of mechanized mining operations in the Pittsburgh field and discussed the operating problems and difficulties encountered in the mines in this field and described the varying degrees of successes that were being attained by mechanical loaders, scrapers and conveyors.

A moving picture illustrated the conveyor system of the H. C. Frick Coke Co., and numerous lantern slides showed early and modern types of mine locomotives. In addition to the papers on the program a number of interesting informal discussions were presented by various members.

Pittsburgh Terminal Coal Reduces Wages—Five Mines Operating

The Pittsburgh Terminal Coal Corporation has reduced wages to a scale corresponding with that paid by the Pittsburgh Coal Company. Day labor was cut from $6.75 to $6.

The company is operating five of its former union mines on a non-union basis and is producing over 7,000 tons of coal daily. The company is building 100 miners houses at its No. 9 mine at Acella, Pa.

The Pittsburgh Coal Company is operating 18 of its Pittsburgh district mines, and is producing better than 160,000 tons a week. The average number of men working is around 6,700.

It is reported that preparations are being made to reopen the Gibson mine of the Hillman Coal & Coke Company at Bentleyville, Pa., on a non-union basis. About 400 miners will be employed.

Lake Cargo Coal Rates

Lake cargo coal rates will be considered again by the Interstate Commerce Commission at two hearings, one in Washington, beginning November 16, and the other at Minneapolis, beginning November 29. Commissioners Campbell and McManamy were assigned to conduct the inquiries. The phase of the lake cargo rate controversy to be taken up for reconsideration is the 20-cents-per-ton rate reduction on lake cargo coal which railroads serving West Virginia, Tennessee and Kentucky attempted to put into effect in August. The commission suspended the reduction and ordered the inquiry.

Pittsburgh Coal Mining Institute Meets

More than 100 persons attended the semiannual meeting of the Pittsburgh Coal Mining Institute at Pittsburgh, October 8. The program dealt principally with safety work, and was conducted by William McCoy, safety engineer of the Buckeye Coal Company and president of the institute.

Two collieries of the Hudson Coal Company near Wilkes-Barre, on the Delaware and Hudson Company lines, have resumed mining after a shutdown of several months. Others are expected to resume shortly.

Permanent Rescue Teams in West Virginia

At the last session of the West Virginia legislature a bill was passed providing for 20 permanent mine rescue teams in the state. The teams are to consist of six men each and are to be trained by the state and paid by the state, giving to the state 120 expert mine rescue men ready for service at any time. Formerly the state has depended on volunteer teams in case of disaster or mine fire. Announcement has been made by Lazier McGee, of the Department of Mines, that the two permanent mine rescue teams for the Fairmont region would be a team from the Jamison No. 8 mine and No. 9 mine and a team from the Thermal mines of the Cosgrove-Meehan company.

Mr. McGee will have charge of the two permanent teams in the Fairmont field and two teams in the Morgantown field. These 24 men will be given training twice each month. They will receive all rescue instruction from elementary through advanced and will devote most of their training hours to practice and study of the newest and most modern methods of rescue work as these things are discovered.

Official announcement comes from the Carnegie Institute of Technology in Pittsburgh that a second International Conference on Bituminous Coal will be held there during the week of November 19, 1928.

Decision to call a second congress of world scientists and fuel technologists has been made, it is announced, as a result of the widespread interest aroused throughout the world by the first Conference on Bituminous Coal held at the Carnegie Institute of Technology in November, 1926.

Although no definite program plans for the second conference have been made, it is expected that the 1928 session will cover the latest developments in obtaining substitutes for gasoline from coal, power from coal, low and high temperature distillation processes, smokeless fuel, gasification of coal, utilization of coal tar products, coal as a source for fertilizer, and coal in relation to the production of fixed nitrogen.

Dr. Thomas S. Baker, president of the Carnegie Institute of Technology, who called the first conference, visited Europe this past summer for the purpose of discussing phases of the second conference with eminent scientists in France and Germany. He plans to pay another visit to Europe in 1928 to invite speakers and delegates.

Union Activities Against Pittsburgh Terminal Coal Company Are Halted by Injunctions

One of the most sweeping Federal Court injunctions in the history of labor disputes was put into effect October 11 at Pittsburgh against the United Mine Workers of America, its officials and its members. Practically every activity of the union, directed against the nonunion Pittsburgh Terminal Coal Corporation, was restrained by the preliminary order handed down by Judge F. P. Schoonmaker.

The court upheld the contention of the corporation that the union had hampered interstate shipment of coal in violation of the Sherman and Clayton Acts. The chief point of the corporation in its suit—to regain possession of company-owned houses occupied by striking miners—was decided in favor of the plaintiff, for the union and its members were restrained from in any way seeking to maintain union men in the dwellings against the wishes of the corporation.

The court held the corporation was entitled to the preliminary injunction because it appears that immediate and irreparable damage and loss will result to plaintiff unless a preliminary injunction be granted, and that for such damage and loss the plaintiff is without any adequate remedy of law.

Nothing was said in the preliminary decree concerning the prayer of the corporation for damages of $1,500,000.

The Pittsburgh Terminal Corporation was a union stronghold until April 1, when the company posted a wage scale lower than the union scale, and union miners suspended work. Since that time the corporation has sought to operate with nonunion miners, joining the ranks of other open-shop operators, including the Pittsburgh Coal Co. The injunction is expected to make it less difficult to obtain and keep nonunion miners.

Green Scores Order

President William Green, of the American Federation of Labor, said that the order signed by District Judge Schoonmaker in Pittsburgh, "in my opinion completely destroys all rights of the United Mine Workers employed in the mines of the Pittsburgh Terminal Coal Corporation."

"Evidently the injunction issued by United States District Judge Schoonmaker," Green commented, "is sweeping in its extent and is a further step of encroachment in the use of the injunction upon the rights and activities of the trades unions."

Mine Union Loses Injunction Fight in West Virginia

The United Mine Workers of America and its president, John L. Lewis, were refused reviews by the Supreme Court in 12 cases in which the Federal District Court for Southwestern Virginia granted injunctions to the Red Jacket Consolidated, the Borderland and other West Virginia coal mining companies restraining the union and its officers from certain acts in their efforts to unionize coal mines in West Virginia.

The constitutionality of the injunction was attacked by Lewis and the United Mine Workers, particularly the feature which would have the effect, they claimed, of preventing them from urging employes of open-shop mines to join the union.

The mining companies contended with success in the lower courts that the union, its officers and members, should be prohibited from attempting to persuade their employes from breaking their contracts which provided that they would not become members of the union. They insisted that the injunction did not prevent their employes from joining the union provided they did not remain in their employ.

The injunction, among other things, prohibited the union, its officers and members from interfering by threats of violence with the employes of the mines bringing the suits from destroying the property of those companies and from interfering with their interstate business.

The lower courts found that the union and its members were engaged in a conspiracy to restrain interstate commerce by interfering with the production and shipment of nonunion coal.

Bulletin to Tell Mining Methods

Publication in December of a bulletin containing an exhaustive study of the various methods used by operators of West Virginia was announced recently by Prof. Charles E. Lawall, head of the School of Mines of West Virginia.

The data for the treatise has been obtained, Professor Lawall said, during the past year by Ivan A. Given, of Sutton, and Harry G. Kennedy, of Morgantown, son of D. C. Kennedy, secretary of the Kanawha Coal Operators' Association.

Every district in the state has been visited and material collected with the exception of the Wheeling and Elkins territories, which will be inspected within the next few weeks, it is stated.

After the work has been published, Professor Lawall stated, it will be distributed to every coal operator and coal company in the state in order that they may improve, if possible or necessary, the methods of mining used in their own plants.

The dissemination of the information embodied in the forthcoming bulletin among West Virginia operators is expected to have a generally good effect in aiding the operators to lower their average cost per ton of producing coal.

Both of the young men engaged in collecting and writing the new work were graduated from the university with the degree of mining engineer in 1926.

A. J. Maloney New President of Coal and Iron Company

At the annual meeting of stockholders of the Philadelphia and Reading Coal and Iron Company, on October 10, held at Philadelphia, Andrew J. Maloney, vice president of the Chicago, Wilmington and Franklin Coal Company, Chicago, was elected president, to succeed Joseph Wayne, Jr., who has temporarily filled the office since the resignation some months ago of W. J. Richards. Mr. Maloney, at a special meeting of directors of the Philadelphia and Reading Coal and Iron Corporation on the same day, was chosen president of that organization.

The new head of the Coal & Iron Company is 43 years of age, and is a native son of Girardville, Pa., which is located in the heart of the anthracite field. He spent his early days in Schuylkill County, coming to Philadelphia in the year 1900. He later entered the evening school of Temple University, and remained in that institution until 1906, at which time he was the traffic manager of the Whitehall Portland Cement Corporation. In 1906 the Wentz interests sent him to Illinois as vice president and sales manager of the Royal Colliery Company at Virden. Under his management the company made rapid progress, and eventually was merged into the Chicago, Wilmington and Franklin Coal Company. Mr. Maloney continued as vice president and sales manager of that company until his election to the presidency of the Philadelphia and Reading Coal and Iron Company, when he resigned.

The following directors of the Philadelphia and Reading Coal and Iron Company also were elected: Robert J. Cary, Robert J. Montgomery, George H. Campbell, Joseph Wayne, Jr., Newton H. Fairbanks and Leon E. Thomas. The latter is a new member of the board, taking the place of George C. Coughlin. Mr. Thomas is president of the Reading Iron Company, a subsidiary of the coal and iron company.

H. B. Lee Heads Indiana Association

At the annual meeting of the Indiana Coal Producers' Association, which was held October 17 at Indianapolis, the following officers were elected:

President—H. B. Lee, president, Maumee Collieries Co., Terre Haute, Ind.

Vice President—J. T. Moorman, president, Patoka Coal Co., Indianapolis, Ind.

Secretary-Treasurer — Michael Scollard, Terre Haute, Ind.

These officers, together with the following operators, compose the new executive board: Fred S. McConnell, vice pres., Enos Coal Mining Co., Cleveland, Ohio; R. H. Sherwood, president, Sherwood Coal Co., Indianapolis, Ind., and R. C. Woodie, general manager, Midcontinent Coal Co., Danville, Ill.

A resolution pertaining to reforestration was adopted by the strip mine owners. A reforestration program, outlined by Richard Lieber, state director of conservation, consists of having each operator plant five acres of land for each unit of stripping machinery now in operation. The program requires the planting of 300,000 spruce trees a year, the trees to be furnished from the state forest nursery.

OUR COAL EXPORT TRADE

DURING the first six months of 1927 the four chief coal exporting countries shipped a total of 55,800,000 tons of anthracite and bituminous, compared with 49,200,000 tons in the corresponding period of 1925, according to John R. Bradley, Minerals Section, Department of Commerce. (Comparison has not been made with 1926, owing to the British coal strike in that year.) Germany showed the greatest gain—14,000,000 tons in 1927 against 10,600,000 in 1925; the United States had 10,100,000 tons against 8,000,000 tons; and Poland 5,300,000 tons against 4,600,000 tons. Exports from Great Britain in the first half of the present year were slightly greater than in the first half of 1925, notwithstanding restrictions on the importation of coal in many coal-producing countries, including countries which have imposed import duties—France and Germany, which require a license for its importations, and Spain, where certain industries are required to use a specified percentage of the national product, an arrangement which, it is reported, Portugal is about to follow.

In the above figures the tons are long tons in the case of the United States and Great Britain and metric tons for Germany and Poland. Anthracite and bituminous figures have been combined for the United States, because the export statistics of other countries do not segregate the two kinds. Poland exports no anthracite and Germany very little. British exports of anthracite are chiefly to France and Italy. Our own exports of this commodity are mainly to Canada, where in recent years it has had to compete with the British article.

From 75 to 80 percent of the American exports normally go to Canada, but Italy, Brazil, France, Argentina and Uruguay import fair amounts. Our exports to Canada for the six months of this year show an increase of 30 percent over those for the corresponding months of 1926, while British exports increased 73 percent. Our figures are for anthracite and bituminous, combined; practically all of the British exports were anthracite only.

Prospects for Increased World Consumption of Coal

The outlook seems good for an increase in world consumption of coal, owing to the more stable economic conditions prevailing throughout the world, and the return of most national currencies to parity. Oil fuel for bunkers on vessels was scarcely used in 1913, while 35 percent of the world's tonnage of steam and motor ships burned oil in the fiscal year 1926-27, only 62 percent using coal. It seems improbable, however, that this rate of increase will be maintained hereafter. Moreover, experiments indicate that powdered coal may soon begin to replace oil for bunkers. The development of hydroelectric power continues in a number of countries, but Italy in recent years has greatly increased the use of such power and yet its importation of 12,000,000 tons of coal in 1926 set a new high record. The more efficient use of coal in certain countries has, no doubt, reduced consumption in no small way, but its continued influence is difficult to gauge. Except in the West Indies, Central America, and Chile, coal consumption is increasing in the countries where the United States has a foothold or better—Canada, Argentina, Brazil, Italy, and North Africa—but if it can not reduce prices further even this hold on the market will slip.

Lake Erie Coal Loadings

Lake Erie coal loadings for the season to October 2 totaled 27,266,980 tons, a gain of 4,593,212 tons over last year, when 22,673,768 tons had been loaded to the same date. Loadings for 1925 at that date were 20,331,154 tons and 17,796,749 in 1924.

H. M. Griggs, manager of the Ore & Coal Exchange, expects total loadings this year to pass the 35,000,000-ton mark and better the high record of 1926 by about 6,000,000 tons.

C. A. Cabell Heads Kanawha Coal Operators' Association

C. A. Cabell, president of the Carbon Fuel Co., of Charleston, W. Va., was elected president of the Kanawha Coal Operators' Association at the annual meeting, at Charleston, October 20, succeeding D. H. Morton, who, through a sale of the American Eagle Colliery, has retired from the industry. W. C. Mitchell, persident of the Coalburg Kanawha Coal Co., of Coalburg, W. Va., was reelected vice president, D. C. Kennedy as secretary, and John L. Dickinson, vice president of the Dickinson Fuel Co., of Charleston, as treasurer.

Messrs. C. A. Cabell, W. C. Mitchell, J. Dearing Christian, asst. to pres., Imperial Colliery Co., Lynchburg, Va.; John Laing, pres., Wyatt Coal Sales Co., Charleston, W. Va.; John S. McKeever, gen. supt., Kanawha & Hocking Coal & Coke Co., Longacre, W. Va.; W. M. Wiley, vice pres., Boone County Coal Corp., Sharples, W. Va., and Frank O. Harris, gen. mgr., Cannelton Coal & Coke Co., Cannelton, W. Va., were reelected as members of the board of directors, while L. M. Webb, pres., Webb Coal Mining Co., Cincinnati, Ohio, and Everett Drennen, pres., West Virginia Southern Coal Co., New York City, were elected as new members.

Harry L. Gandy, secretary of the National Coal Association, spoke at the business meeting, reviewing the work of his organization, and Dr. D. W. Daniel, president of Clemson College, of South Carolina, was the main speaker at the annual dinner. W. M. Wiley presided as toastmaster.

The various reports showed the Kanawha Association to be in excellent condition and Mr. Kennedy was warmly congratulated upon the conclusion of another year of successful effort under his secretaryship. Attorney A. M. Belcher, of Charleston, who prepared the original complaint for an injunction in the Federal court against the organization activities of the union, was present and spoke briefly on the legal situation, saying that he interpreted the decision of the Supreme Court in refusing to review the action of the Circuit Court of Appeals in sustaining the West Virginia injunctions as a "new bill of rights for employers under which they might operate their business as American citizens."

H. Morrow Heads Alabama Institute

Hugh Morrow, president of the Sloss-Sheffield Steel & Iron Company, was elected president of the Alabama Mining Institute at a meeting of the board of directors, October 11. A. B. Aldridge, general manager of the Stith Coal Company and president of the Southeastern Fuel Company, was elected vice president. James L. Davidson, secretary, and H. E. Mills, assistant secretary and statistician, who have served the institute in this capacity for a long number of years, were reelected for another term. Harold McDermott, of the New Castle Coal Company, was elected to fill out the unexpired term of A. B. Aldridge on the board of governors. The other new members of the board of governors are Molton Smith, C. T. Fairbairn, and Henry T. DeBardeleben.

Will Reequip Old Alabama Mine

The Consolidated Coal Company, a newly organized Alabama corporation, has purchased what is known as the Bankhead coal properties in Walker County, near Jasper, Ala., on the Northern Alabama Railway. These properties were formerly owned and operated by the Pratt Coal & By-Product Corporation, this company having been thrown into receivership several months ago. These holdings contain a large acreage of fine big seam coal, which has only been developed through the Bankhead mine. The consideration involved in the purchase was about $1,500,000, and the new owners expect to expend $200,000 in the construction of a new washer and preparation plant of large capacity and in the installation of haulage and inside mining equipment which will thoroughly modernize the operation and equip it for the production of 2,000 to 2,500 tons daily from the present slope opening. The present partial electrification will be extended to all units. R. T. Daniel, Birmingham, is president of the company and has associated with him well known coal men of New Orleans.

Hudson Coal Company

Withdrawal by Hudson Coal Co. of its appeal to the U. S. Supreme Court from a decision ordering payment to State of Pennsylvania of several millions in back taxes on anthracite produced has been generally interpreted as surrender by the company of its position against the tax, according to the *Wall Street Journal*. It may be authoritatively stated that the company has not surrendered its position nor settled the suit brought against it by the state.

Taxes accrued in 1921 and to date have been unpaid, though the company has set up reserves in the event of obligation to pay them. The tax calls for payment to the state of 1½ percent on the mine price of coal produced.

At Yorktown, Pa., the Lehigh Valley Coal Company is clearing the ground at its No. 5 colliery to permit the taking out of all the anthracite remaining unmined in that section of its Yorktown tract.

Receiver for South Penn Collieries Co.

Robert H. Buchanan has been appointed receiver in equity of the South Penn Collieries Co., which owns, leases, and operates anthracite coal mines in Schuylkill, Northumberland, and Lackawanna Counties, Pa. The appointment of Mr. Buchanan, who is president of the company, was in a friendly suit by Sheafer and Lowrey, of Philadelphia, creditors, because of the company's lack of operating capital. The company consented to appointment of the receiver. It is claimed the company is solvent, having assets of a book value of $15,000,000. Its liabilities consist of first mortgage bonds outstanding of $4,031,500; second mortgage bonds of $2,000,000, and general debt of $1,700,000. Default has been made in the payment of interest due July 1 last on the second mortgage bonds. The receiver is authorized to continue the business until further order of the court.

First Coal From Bemis

The Cheat Mountain smokeless field, in Randolph County, W. Va., which has been under development in recent months, assumed a position among the producing districts early in October when the Monserrat Mining Company, a Columbus, Ohio, concern, shipped the first car of coal from its new plant at Bemis. There are now two companies producing coal on a commercial scale in the field, the Walker New River Mining Company having begun the shipment of coal about a month ago. Both companies are operating their mines regularly and expect to be in a position to increase their output.

Striking Pittsburgh Miners Promised Aid

Promises of political, financial, and moral support for the striking coal miners in the Pittsburgh field were made early in October by International Vice President Phillip Murray, of the United Mine Workers, at a mass meeting at Monongahela, Pa., when he assured the somewhat discouraged workers that the Federation of Labor and its affiliated bodies were going to contribute to their cause in the immediate future. He also assured the miners that the labor leaders were going after Governor Fisher, of Pennsylvania, and demand justice from him and the state authorities. Murray did not say so, but it is generally known in the coal fields that the number of strikers in Pittsburgh district has diminished to a startling extent, as the workers have penetrated into the non-union fields of West Virginia and are said to be working for less than the wage rate offered by the Pittsburgh producers.

More Dams in Tennessee River Urged to Aid Industry in South

Statements that the industrial growth of the South depends upon making plans now to provide extra power; that no changes in the Federal water-power act should be made; that the Muscle Shoals problem should be disposed of; that the ban on developments on the Tennessee River should be lifted and that no power trust exists in this country are among the striking points brought out before sessions of the Southern Appalachian Power Conference.

W. K. Onken, editor of the Electrical World, deplored the interference of politics with Muscle Shoals and called attention to the paralyzing effect of politics wherever it touched the industrial problems.

Paul S. Clapp, managing director of National Electric Light Association, and formerly an aide to Secretary Hoover, said he had spent 17 months in Russia under Soviet regime and that had he needed anything to convince him of the stifling of individual initiative by Government ownership or control, his experience in Russia had supplied it.

He declared that since the World War the increase in mass production due to the increased electrification of industry had made it possible to keep the wages of labor up to wartime levels in many industries.

The Chattanooga conference is regarded as the forerunner of a demand upon the part of business interests of Tennessee that the Federal Power Commission approve the long-pending permits for the development of water-power dam sites in the Tennessee River. It is estimated that more than $100,000,000 of capital is awaiting the building of these dams to move to this section.

Mr. Onken took occasion strongly to uphold the Federal water-power act and urge opposition to any move to amend it. There is no power trust in this country and no tendency toward one, J. T. Newcomb, counsel for Joint Committee of the National Utility Association, declared in an address. He quoted findings of the Federal Trade Commission which he said should answer any such argument.

Cost Reports Hit Again

The District Court of Appeals has under advisement the appeal of the Federal Trade Commission from the recent action of Justice Bailey of the District Supreme Court granting a permanent injunction to the Maynard Coal Company in the matter of cost reporting. The Maynard case is similar, though less comprehensive, than the Claire Furnace case which the United States Supreme Court finally disposed of a few months ago.

Gas Production Soon to Be Minor Department of Gas Corporations

The business of producing manufactured gas in the future will be a minor department of a great industry vertically integrated, beginning with coal in the ground, and oil, which is merely another form of it, and ending with motor fuels, dyes, medicines, and explosives, Philip Cabot, Harvard School of Business Administration, Cambridge, Mass., declared at the convention of the American Gas Association in Chicago, October 11.

"The production of gas as now carried on is not one industry but four," Mr. Cabot stated. "What we call the gas business consists in the production, actual or potential, of gas, coke, tar, and ammonia, and motor fuels. Gas men refer to gas as their main product and coke, tar, and ammonia as their by-products, because they are gas men, but to the fuel merchant coke is the main product, the gas often being a pure waste, while to the manufacturing chemist the coal tar offers a field of activity and economic development which overshadows all other products of the coal. In the production and marketing of the coal-tar derivatives we have so far been very backward, but they contain a future inseparable from the development of the gas industry and may perhaps become the dominant factor of it."

OIL SHALE "DISCOVERY" DEFINED

Interior Department Holds That Initial Discovery At Or Near Surface Is Sufficient To Justify Patent

A DECISION of the utmost importance to the oil shale industry of the United States was handed down by the Interior Department early in October, when Secretary Work approved a ruling to the effect that an initial discovery of oil shale at or near the surface is sufficient to justify an oil shale patent under the general mining laws. This comes as a climax to a matter that has been pending since early last winter when representatives of those interested in the development of shale deposits appeared before Interior Department officials to urge a change in the regulations as to what shall constitute a "discovery" of an oil shale deposit.

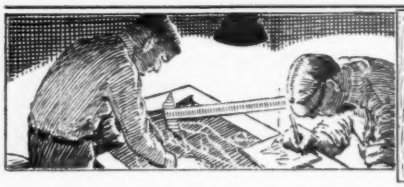
The test case just decided, around which the whole question revolved, was that of J. D. Freeman v. George L. Summers, and Standard Shale Products Co. v. Summers. The Shale Company and Freeman contested homestead and stock raising entries of Summers on the ground that they themselves were entitled to the land under prior placer mining claims. The department's former decision against the shale claims was based on the ground that at the time of the approval of the mineral leasing act no discovery of a valuable deposit of oil shale had been made on the lands, nor had work leading to a discovery been diligently prosecuted.

At the hearing held last winter it was argued by the shale claimants that the Green River formation in Colorado, taken as an example, is one massive deposit, any part of which will, upon distillation, produce oil in varying quantities, and that a location on any part of this deposit should constitute a discovery. The department sustains this contention in the following language: "* * * while the beds vary in the richness of their content, the formation is one upon which the miner may rely as carrying oil shale which, while yielding at places comparatively small quantities of oil, in other places yields larger and richer quantities of this valuable mineral."

The ruling sets aside an impression that has prevailed that regulations of the Geological Survey regarding classification of oil shale land are to determine in all cases whether sufficient discovery has been made to justify a patent. It is stated that each case must be decided upon the facts disclosed. The survey regulations referred to stipulated that where shale beds are too deep to be mined by open-cut methods, oil shale lands must contain shale capable of yielding 1,500 barrels of oil per acre in beds not less than a foot thick, producing 15 gallons per ton and within a reasonable depth below the surface. The survey regulations also required that in beds subject to open-cut mining the lands must contain shale to yield 750 barrels of oil per acre in beds not less than 6 inches thick and yield not less than 15 gallons per ton.

In defining the requirements for a mining claim, the department says: "It is sufficient if he (the locator) finds mineral in a mass so located that he can follow the vein or the mineral-bearing body, with reasonable hope and assurance that he will ultimately develop a paying mine."

"It is not necessary, in order to constitute a valid discovery under the general mining laws sufficient to support an application for patent, that the mineral in its present situation can be immediately disposed of at a profit," says the decision.



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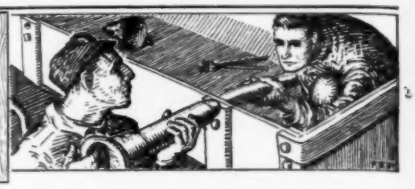


New Takeup By Link-Belt

The Link-Belt Company, Chicago, has announced an improved design "Protected Screw" type takeup for heavy work and long-movement to be known as Style "DS."

The diameters of screws, lengths of bearings, strenghts of frames, etc., are all correctly proportioned for the size of shaft, and length of movement, insuring maximum strength with minimum weight.

Frame is of welded structural steel with channel base welded to ends formed of steel plates, bent and welded into strong box members, in which the adjusting screw is mounted.

The steel angle bolted on top of ends protects the screw from dirt or the weather, in addition to tying the ends together, strengthening the frame, and preventing upward movement of the bearing.

The protected screw remains fixed in position, and the nut for adjusting the movement of bearing travels on the screw. A circular has been issued describing this.

Electrically Controlled Automatic Cleaning and Pickling Machine

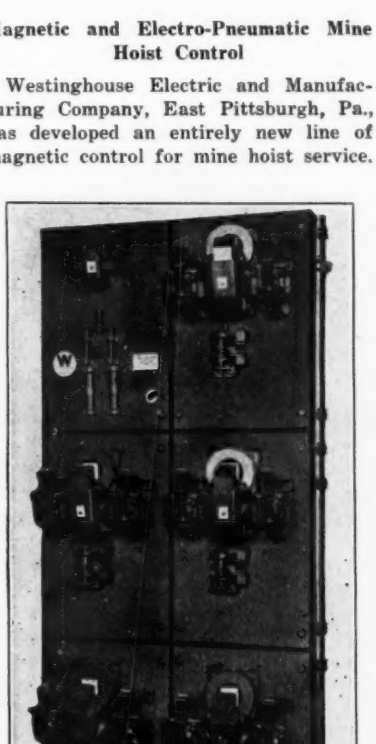
The Bridgeport Brass Company, at Bridgeport, Conn., has installed two automatic cleaning and pickling machines on which electric control is applied for the first time to govern the various steps in the process. The machines in question not only eliminate several men from the department but also provide greater production at less cost.

Carriers on an endless chain convey the work to be cleaned and pickled from a filling station, through the various baths, to an unloading station. General Electric motors and control are used. On pressing a button the carriers move from one position to the next and stop. After a predetermined time all carriers move to the next position. The time elapsing between moves is determined by setting a timing relay; one machine operates on a 70-second cycle, and the other on a 20-second cycle.

The machine described was built by the U. S. Galvanizing and Plating Equipment Company, of Brooklyn, N. Y., and the electric equipment is of General Electric manufacture.

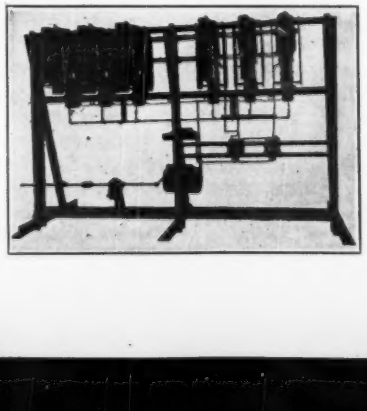
Magnetic and Electro-Pneumatic Mine Hoist Control

Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., has developed an entirely new line of magnetic control for mine hoist service.



All contactor panels are furnished 76" high for lining up with standard 76" high switchboard panels and are provided with channel iron sills.

The high voltage air break reversing contactors are provided with current interlocks to prevent one contactor from closing until the arc has been completely extinguished on the contactor being opened.



Both high and low voltage reversing contactors are mechanically interlocked.

In the new development of high voltage reversing contactors, the two-pole design has been retained on account of space and safety considerations. The connection of the two-pole contactors provides opening of all power leads to the motor stator and insures against overwinds as the opening of any two-pole contactor opens two phases of the line.

The arc-rupturing ability of these high voltage contactors provides reliable operation even under adverse conditions.

The contactors are of the floating armature construction which are self-aligning.

The company has also developed an alternating current magnet valve for operation of electro-pneumatic unit switches. Heretofore only direct current magnet valves have been available, thus requiring direct current for operation of the magnet valves and control circuits. This important development permits the use of alternating current control circuits and by eliminating the small motor generator formerly required, the cost of the complete electro-pneumatic control for mine hoists is materially reduced.

New Time-Delay Push-Button Station Keeps Motors Running

General Electric announces a new push-button station for use in preventing the cutting out of motors controlled by a magnetic starter, when there is a brief power disturbance. The station has two push buttons, "Start" and "Stop," and bears the General Electric designation CR-2940-BS-82-A.

This station is used with standard magnetic starters, making it unnecessary to add time-delay attachments to the starters themselves. When power fails, the magnetic starter will, of course, drop out, but will be caused to reclose upon the return of voltage by the push-button device—unless the time for which the push-button station is set is exceeded, when the "Start" button must be pushed to energize the magnetic starter and so restart the motor.

In operation, pressing the "Start" button of the push-button station closes the pilot circuit of the magnetic starter and also the circuit of a coil in the push-button station. This coil is part of a "lift" solenoid and, when energized, causes the solenoid plunger to rise. At the bottom

of the plunger are spring-attached contacts which are closed by the lifting action, thus maintaining the circuit through the solenoid itself and also the pilot circuit of the magnetic starter with which the device is used.

When voltage drops sufficiently to permit the solenoid to release the plunger, the latter starts to fall but is retarded in its downward movement by a rack which turns a gear. The gear engages a ratchet which can be adjusted for a maximum of 1½ seconds by means of a heavy nut at the end of the rod which serves as a pendulum. If power does not return before the time expires for which the device is set, then the contacts will be opened and both the solenoid and the magnetic starter will be disconnected until the "Start" button is again pushed.

Pressing the "Stop" button stops the motor immediately, because this action immediately opens the pilot circuit of the magnetic starter and likewise disengages the rack of the solenoid plunger so that the latter falls instantly.

New Cable Organization

The organization of a large electrical wire and cable company under the name of General Cable Corporation was forecasted recently by the mailing of notices calling meetings of stockholders to approve action taken by the boards of directors of certain of the companies whose assets will be owned by General Cable Corporation. When the organization of General Cable Corporation is completed, it will own the assets and businesses now operated by Dudle Manufacturing Corporation, Rome Wire Company, Safety Cable Company, and Standard Underground Cable Company, and the sheet and rod and wire mills of Baltimore Copper Smelting and Rolling Company.

General Cable Corporation will have plants at the following strategic points in the United States and Canada: Bayonne, Perth Amboy, Newark, and Harrison, N. J.; Rome and Buffalo, N. Y.; Pawtucket, R. I.; Baltimore, Md.; Chicago, Ill.; Pittsburgh, Pa.; St. Louis, Mo.; Fort Wayne, Ind.; Oakland, Calif.; and Hamilton, Ontario.

The company will market all kinds of copper wires and cables, from the finest of enamel wire for delicate electrical instruments to the largest cable for aerial and underground service. Brass and bronze wires, tubing, copper rods and sheets will also be included in its manufacture.

The foundry of the American Brake Shoe & Foundry Co., at Burnside, Chicago, Ill., has been purchased by the American Manganese Steel Company, of Chicago Heights, Ill., to make a seventh of a chain of foundries producing manganese steel castings.

Forty-two Dorr Classifiers in Anaconda's Remodelling Program

The Anaconda Copper Mining Company has for some time been remodelling the crushing plant at its Anaconda, Mont., works in order to increase the general efficiency and simplify the flow sheet. Other improvements made in metallurgical practice at this plant have required a finer grinding before flotation, and, accordingly, the classification section of the copper flotation concentrator is now being remodelled along more modern lines.

The 42 small Dorr classifiers which have been operating in closed circuit with the mills since 1917 are being replaced with a similar number of larger and more heavily constructed classifiers of the same make but of the latest type. In addition to giving a finer feed to the flotation machines, the new classifiers have a high sand raking capacity which may be utilized in obtaining the increased grinding efficiencies which result from large circulating loads between the mills and classifiers.

Timken Purchases Control of British Timken, Ltd.

The Timken Roller Bearing Company of Canton, Ohio, and Mr. M. B. U. Dewar of London, England, have, together, purchased from Vickers, Ltd., all of the capital stock of British Timken, Ltd. This purchase gives Timken complete control, throughout the world, of the manufacture and sale of Timken Bearings. Mr. Dewar assumes active management of British Timken affairs.

The Birmingham plant of British Timken, Ltd., is being enlarged, and large quantities of new machinery and equipment have been installed. Officials of British Timken, Ltd., are now at the Canton, Ohio, works making final arrangements for the immediate establishment of factories in France and Germany.

The Alexander Milburn Company, Baltimore, Md., manufacturers of welding and cutting apparatus, portable carbide lights, and paint and lacquer spraying equipment, has opened an office in Boston under the supervision of Messrs. M. B. Crouse and G. B. Malone.

M. Walter Sennhauser, formerly mechanical engineer for Sulzer Brothers, Ltd., Winterthur, Switzerland, arrived at New York September 26 to assume his new duties as chief engineer of the Dry Quenching Equipment Corporation. This company is a new subsidiary of International Combustion Engineering Corporation and was organized to exploit the recently acquired American rights to patents covering the Sulzer System for dry quenching coke.

Combustion Engineering Corp. Receives Contract for New Steam Station

International Combustion Engineering Corporation announces the closing of a contract by its subsidiary, Combustion Engineering Corporation, with the Kansas City Power & Light Company for two complete steam generating units for the Northeast Station. Each of these units will deliver 250,000 pounds of steam per hour continuously.

The boilers are designed for 1,400 pounds pressure, which is said to be the highest operating pressure in use today. The contract includes Lopulco Unit Systems for burning pulverized fuel, water-cooled furnaces, economizers and air preheaters, all manufactured by Combustion Engineering Corporation.

Denver Rock Drill Company and Gardner-Governor Company Consolidated

Announcement has been made of the consolidation of the Denver Rock Drill Manufacturing Company of Denver, Colo., and Gardner-Governor Company of Quincy, Ill. The new company is to be known as the Gardner-Denver Company. Headquarters will be maintained at Quincy and Denver.

W. H. Leonard, of Denver, will be president and J. W. Gardner, of Quincy, will be chairman of the board of directors of the new company. The new company will manufacture rock drills, air and electric hoists, pumps and air compressors.

Du Pont Personnel Changes

Important changes have just been announced by E. I. du Pont de Nemours & Company in regard to the personnel of the Paint, Lacquer and Chemicals Department. William P. Allen, general manager of the department, has been relieved of his duties at his own request and has been granted a leave of absence for one year, beginning November 1, 1927. William Richter has been appointed general manager of the department. J. W. Elms, now divisional manager at Philadelphia, has been appointed assistant general manager. William M. Zintl, heretofore sales director of the paint and varnish division at Philadelphia, has been appointed divisional manager to succeed Mr. Elms. These promotions are all to take effect November 1, 1927.

Walter Springe, who has represented the Heine Boiler Company in the Kansas City and St. Louis territories for the past 25 years, has been recently appointed district manager of Combustion Engineering Corporation for this district. R. J. Robinson has been appointed as branch manager, under Mr. Springe, at St. Louis.

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Little Giant Mills Installed

Eugene E. Schmitz, of San Francisco, recently purchased a Little Giant Ellis mill to replace mill of other make at Greenwood, Eldorado County, Calif. The Blue Canyon Gold Mine Co., Midas, Placer County, Calif., is also erecting a Little Giant Mill.

The Christmas Hill Mine Butcher Ranch, Placer County, Calif., has now on their grounds a 500-ton Ellis mill and are arranging a suitable plant for two mills, or 1,000 ton per day.

G. E. Salisbury has purchased a B-1 mill to be used north of Sawyer's Bar, Siskiyou County, Calif. This makes the seventh Ellis mill used at this location.

New Jeffrey Vice President

The election of Mr. Robert W. Gillispie to vice president and general manager of the Jeffrey Manufacturing Company was announced on October 10. Mr. Gillispie, who for many years was connected with the Bethlehem Steel Company in an executive capacity, joined the Jeffrey organization as vice president and assistant general manager July 1, 1926.

Leaflet on Direct Connected Turbine Generator Units

The Westinghouse Electric and Manufacturing Company, South Philadelphia works, has recently released an interesting and instructive leaflet entitled "Direct Connected Turbine Generator Units, Capacities 5, 7½, 10, and 15 Kw." These units are for 125 and 250 volts direct current operation. The number of the new leaflet is 2000-D. Included in the leaflet are a number of photographs showing the construction and operation of these units.

These leaflets may be obtained at any of the district offices of the Westinghouse Company or at the Advertising Department at East Pittsburgh, Pa.

Flotation Machine

The Denver Eqiupment Company has just issued, as Bulletin No. 2701, an elaborate description of its Denver "Sub A" Fahrenwald flotation machine. It is claimed for the bulletin—and the text bears out the claim—that the booklet is more than a catalog in that it really is a treatise on flotation. In it a world of information is imparted concerning the modern application of the flotation process to the commercial and profitable recovery of metals from ores which, in the past, have not proven of economic value. This bulletin is a high-class educational document on a vitally important subject of interest to all mining interests having ore treatment problems to solve.

Use and Care of Wire Rope

A. S. Leschen & Sons Rope Company, of St. Louis, have just issued a valuable booklet entitled "Practical Information on the Use and Care of Wire Rope." In compiling this book the authors have endeavored to include such items as would enable the users of wire rope to obtain both better and safer results. The correct methods of handling wire rope are graphically described in a manner that the layman will easily understand. Copies may be secured from the company at 5909 Kennerly Avenue, St. Louis.

The September issue of *The Labor Saver*, published by the Stephens-Adamson Mfg. Co., of Aurora, Ill., contains an interesting illustrated article on the modern conveying equipment at a large copper concentration plant. In the same publication is described the manner in which old Great Lakes freight boats are being converted into self-unloaders. Copies of the bulletin, No. 158, may be obtained upon request.

"Industrial Heating"

The first of a series of articles on "Industrial Heating" appears in the *General Electric Review* for October. N. R. Stansel, Industrial Engineering Department of the General Electric Company, Schenectady, N. Y., is the author. The serial was prepared to supply the need for a detailed treatment of the subject of electric heating.

Turbines for Mechanical Drive

Leaflet 3907-C of the Westinghouse Electric and Manufacturing Company describes turbines for mechanical drive in capacities 5 to 750 brake horsepower. They are admirably suited for driving circulating pumps, centrifugal boiler feed pumps, blowers and other rotary apparatus either directly or through the medium of reduction gears. The leaflet contains a number of illustrations together with descriptive information of the turbines.

The D. O. James Manufacturing Company, 1120 West Monroe Street, Chicago, has recently issued Catalog No. 133, completely describing James Generated Continuous-Tooth Herringbone Gears and Speed Reducers. Detailed description of the various features of Herringbone Gears and Speed Reducers is included, together with complete illustrations of types and installations, and full specifications. It contains complete engineering data, and should be of real value to all engineers, operating men, and users of heavy duty speed reducing equipment.

Sullivan High Pressure Angle Compressors

A new 16-page bulletin, No. 83-G, describes the new line of Sullivan high-pressure angle compound compressors, Class "WJ-3," suitable for pressure from 250 to 1,000 lbs. per square inch. These are two stage compressors, the low-pressure cylinder being horizontal, and the high-pressure cylinder vertical, with a vertical intercooler between them. These units are at present available in capacities of 186, 235, and 290 cu. ft. per minute. Both gas and air models are available.

Copies of Bulletin 83-G may be obtained from any office or agency of the Sullivan Machinery Company.

New Sullivan Water Drifter

Bulletin No. 81-M, dated September, 1927, describes the new Sullivan "T-3" Water Hammer Drill, which is the latest development in a drifting or tripod drill for mining, quarrying and contracting service, such as tunnels, shafts, or open-cut excavation.

The "T-3" will drill 14-ft. holes for 1¼-in. powder readily, and under favorable conditions will go much deeper. The machine with 30-in. shell weighs 156 lbs., but shells of 24 or 36 in. feed may also be had. The high drilling speed, smooth operation, with freedom from vibration, and economy of air power and repairs of the "T-3" have been favorably noted by customers. Automatic lubrication in the drill itself is supplemented by the use of an automatic line oiler in the air line leading to the drill. Copies of this bulletin may be obtained from any office or agency of the Sullivan Machinery Company.

Device to Save Electricity for Users

"Edmoore" Power Demand Limitator is the heading on Bulletin No. 11, published by Edward T. Moore, manufacturer, 500 Cahill Building, Syracuse, N. Y. The "Limitator" is an electrical device for automatically controlling and limiting the power demands or peak loads on electric power systems for consumers. It is claimed that by its use many small plants are saving large sums every month. The device is generally connected to the main incoming power lines of a consumer's plant so as to summate all power.

The Limitator will control all types of load, such as motors, enamelling, japaning and baking ovens, and annealing, heat treating, brass, steel and gray iron furnaces, in various industries such as glass works, coal mines, foundries, machine shops, gear works, cement plants, salt mines, brass and steel mills, electrochemical and others.

The bulletin is profusely illustrated.

Can equipment underwrite prosperity?

EQUIPMENT can reasonably be called the material basis of our present civilization—the means of the great advances in the basic industries of mining and agriculture. Accepting this as fundamental, it follows as an essential that production equipment should be 100% efficient.

It is significant that the companies that best weathered the recent coal depression were the ones that were best equipped mechanically. Any operator who turns back his production methods to those of a few years ago faces imminent bankruptcy. The application is obvious—only those companies with the best production machinery can economize to the best advantage.

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Ingersoll-Rand Co., 11 Broadway, New York City.

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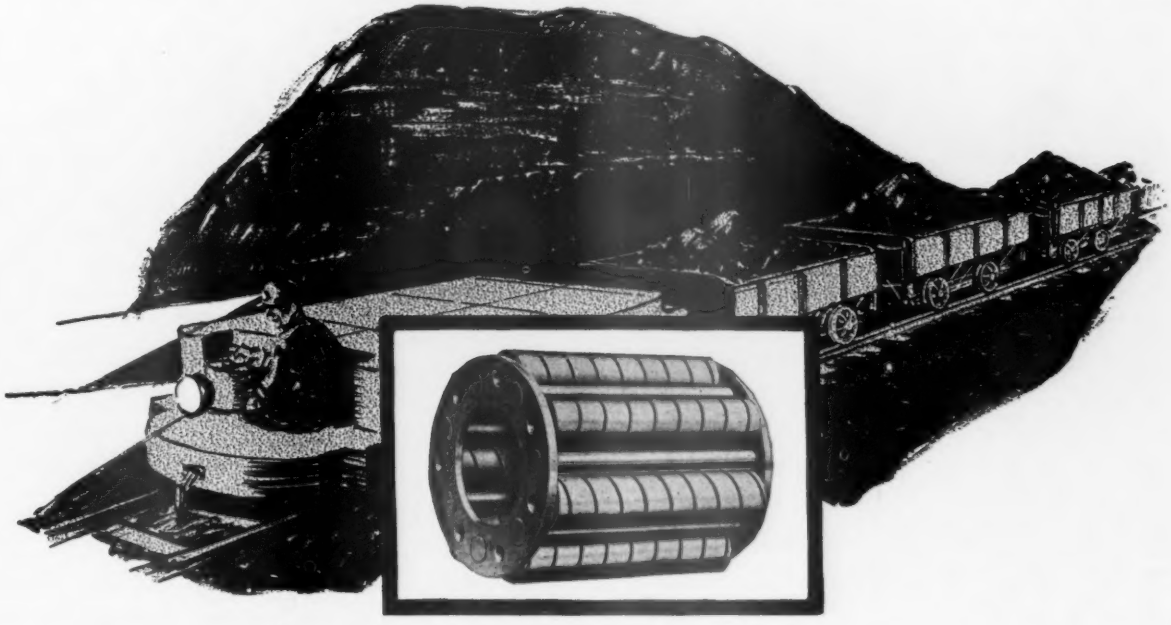

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CONVEYORS, CHAIN FLIGHT
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CONVEYORS, COAL
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CONVEYORS, SCREW
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CORE DRILLING
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Hoffman Bros. Punxsutawney, Pa.

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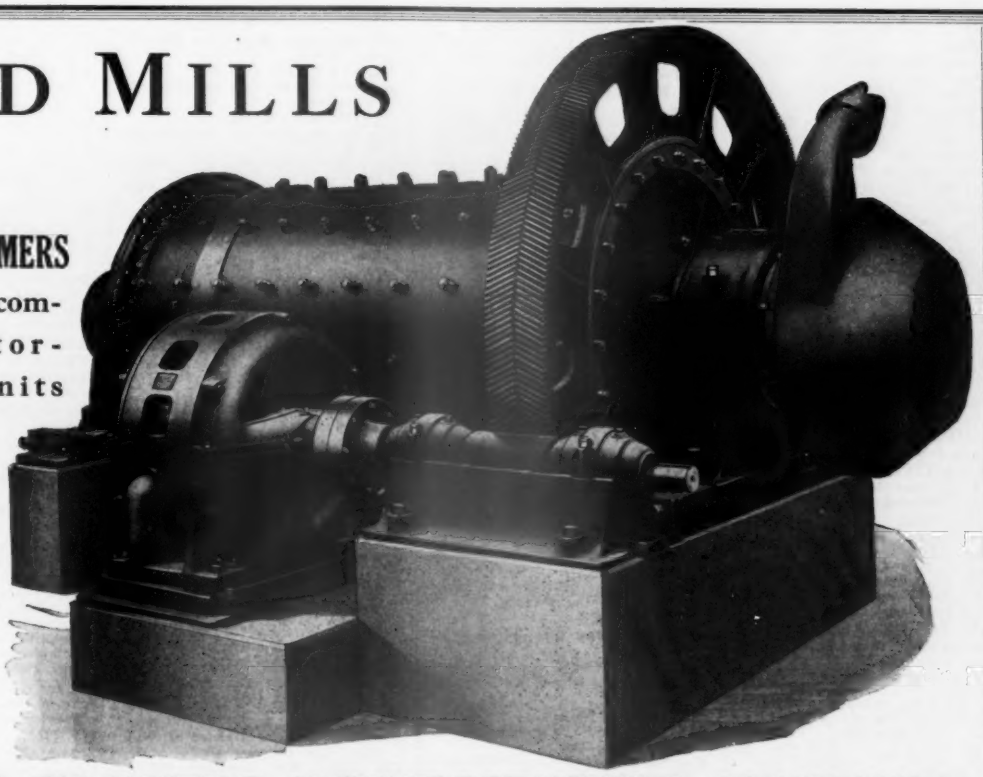

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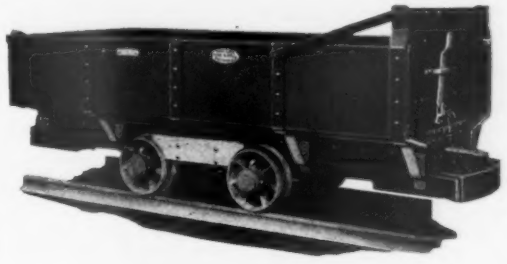

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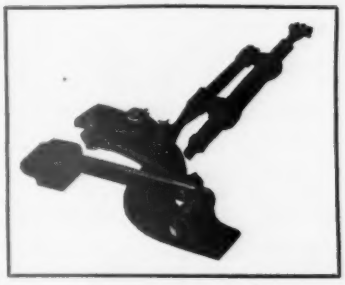

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LOCOMOTIVES, RACK RAIL
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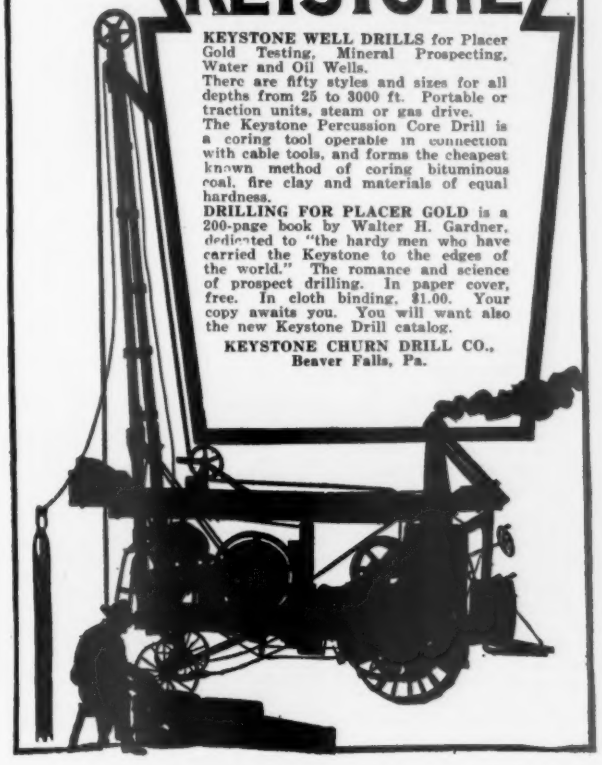

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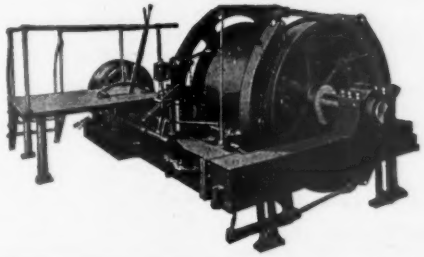

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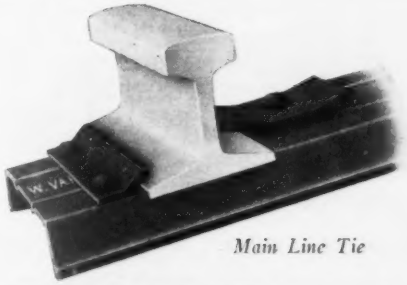

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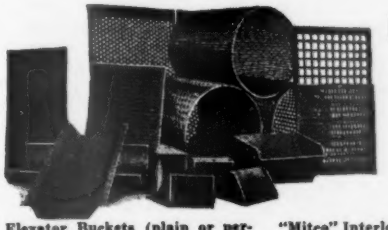

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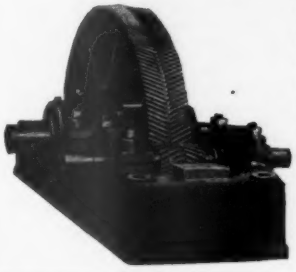

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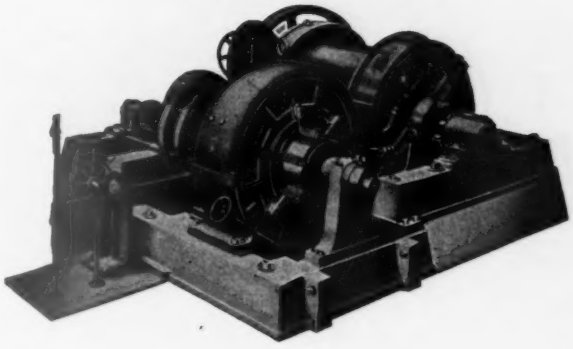

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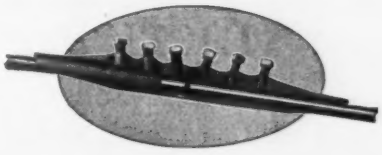

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Chas. Gottschalk, Cons. Engr., Evansville, Ind.
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Mine Timbering

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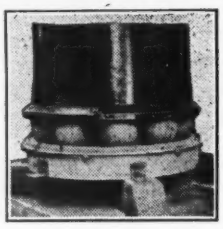

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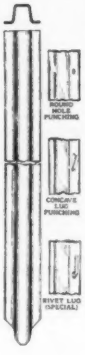

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INDEX TO ADVERTISERS

	Page
Allis Chalmers Mfg. Co	37
Ameling Prospecting Co., H. R	43
American Car and Foundry Co	33
American Coal Cleaning Corp	Inside Back Cover
American Lumber & Treating Corp	39
American Mine Door Co	52
American Steel & Wire Co	28
Atlas Car and Mfg. Co., The	23
Byers Co., A. M	15
Cameron Steam Pump Works, A. S. (Ingersoll-Rand Co.)	5
Carnegie Steel Company	14
Central Frog & Switch Co., The	39
Coloder Co., The	12, 13
Connellsville Mfg. & Mine Supply Co	43
Delamater, G. R	45
Diamond Machine Co	43
DuPont de Nemours & Co., Inc., E. I	30, 31
Ellis Mill Co	52
Enterprise Wheel & Car Corpn	32
Fawcus Machine Co	43
Flory Mfg. Co., S	41
General Coal Co	51
Goodman Mfg. Co	18
Hendrick Mfg. Co	43
Hercules Powder Co	16, 17
Hoffman Brothers Drilling Co	43
Hyatt Roller Bearing Co	35
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works)	5
Irvington Smelting & Refining Works	45
Jeffrey Mfg. Co	6, 7, 8, 9
Keystone Churn Drill Co	41
Keystone Lubricating Co	27
Knox Mfg. Co	Inside Front Cover
Lehigh Coal & Navigation Co	47
Link Belt Co	53, 54, 55, 56
Mine Safety Appliances Co	26
Mining Safety Device Co	45
Morse Chain Co	Back Cover
Myers-Whaley Co	22
Ohio Brass Co	45
Patrick, R. S	41
Pennsylvania Drilling Co	43
Phelps Dodge Corp	45
Phillips Mine & Mill Supply Co	39
Punxsutawney Drilling & Contracting Co	43
Roberts & Schaefer Co	3
Robinson Ventilating Co	37
Roebling's Sons Co., John A	11
Standard Oil Co	19
Stonehouse Signs, Inc	45
Sweet's Steel Co	52
Symons Brothers Co	24, 25
Thompson, W	45
Thorne Neale & Co., Inc	47
Timken Roller Bearing Co	10
Union Carbide Sales	20, 21
United Wood Treating Corp	28
Vulcan Iron Works	29
West Virginia Rail Co., The	41
Willmarth, O. Barlow	43

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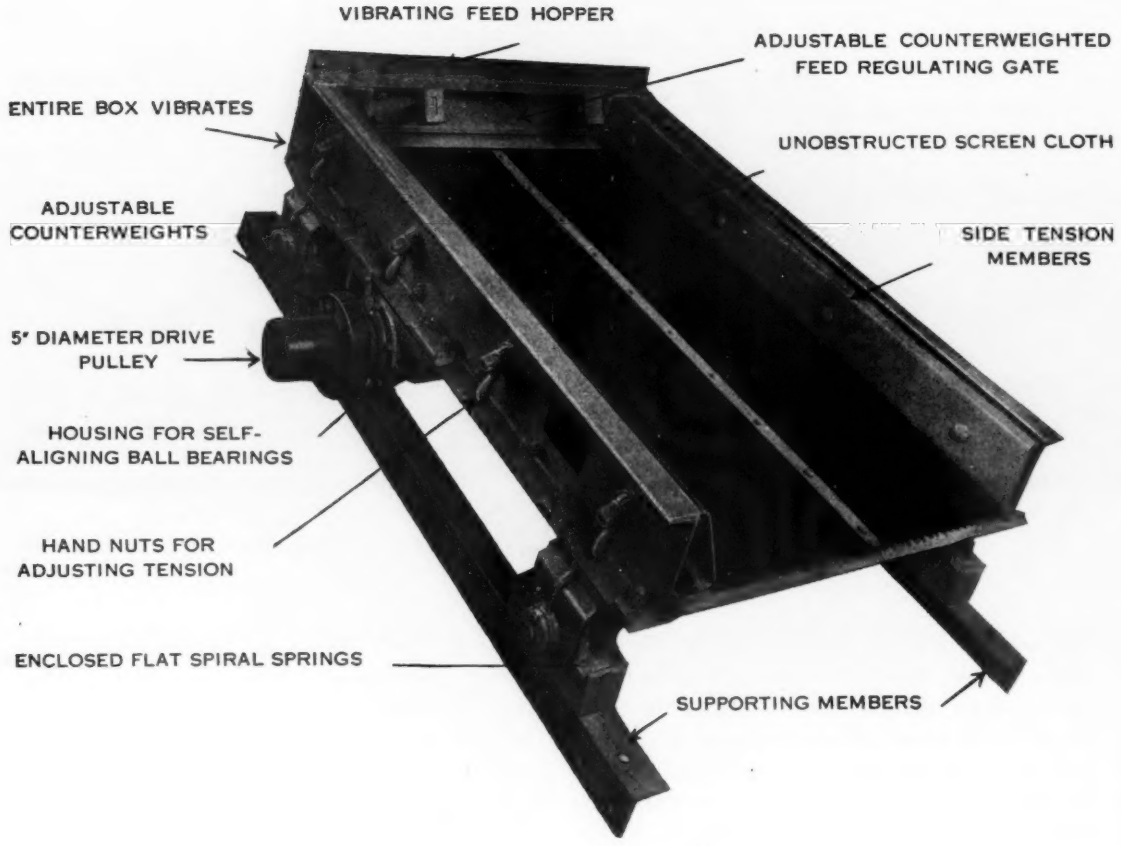

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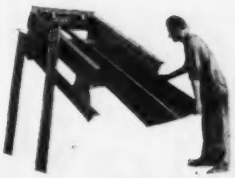

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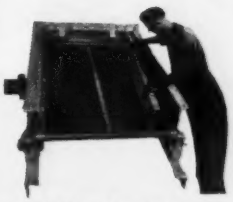

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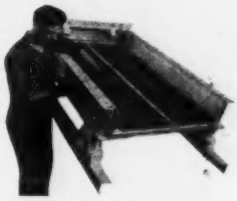

Link-Belt vibrating screen, showing method of adjusting tension in screen cloth.

Side view of Link-Belt vibrating screen. Notice especially the feed hopper; the counterweighted vibrator pulley; and the type of shock-absorbing flat spiral springs on which the four corners of screen box are mounted.

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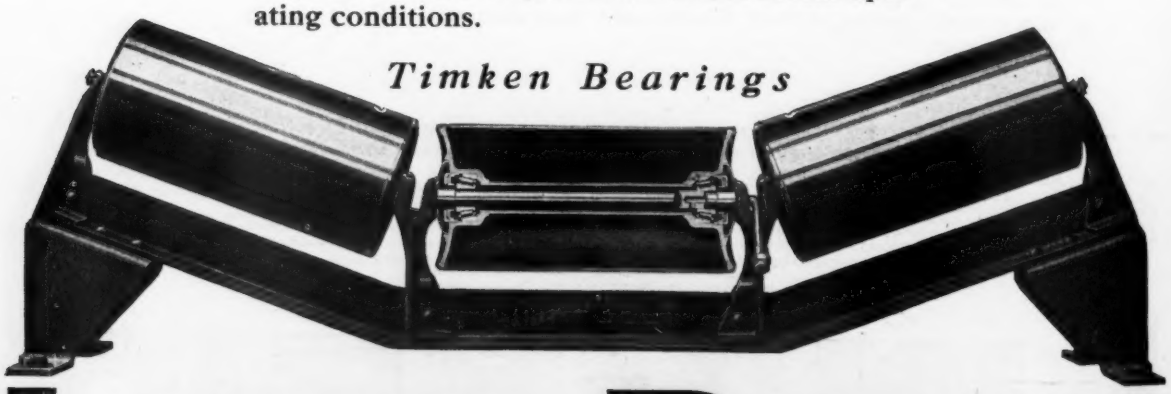

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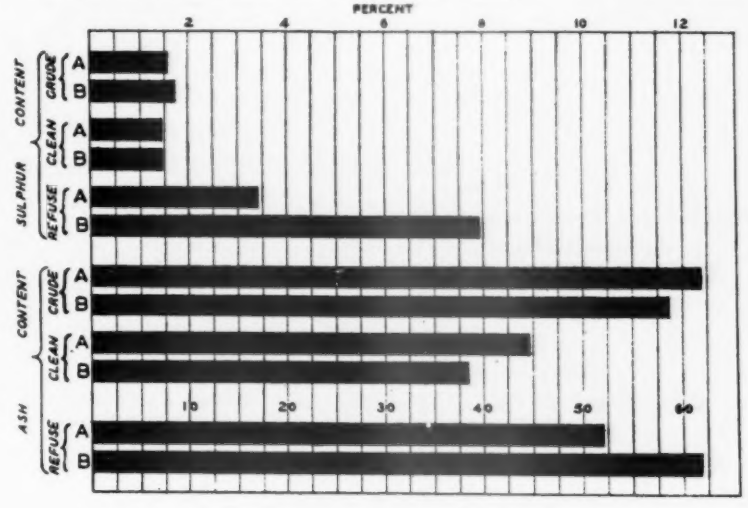
RESULTS OBTAINED BY USE OF AMERICAN PNEUMATIC COAL SEPARATORS COMPARED WITH THOSE OBTAINED BY A COMPETITOR'S EQUIPMENT.



A INDICATES RESULTS OBTAINED BY OTHER EQUIPMENT
B INDICATES RESULTS OBTAINED BY AMERICAN COAL CLEANING CORPORATION

The above graph speaks for itself. It shows, by actual comparative tests, the higher efficiency of AMERICAN Pneumatics.

Results given for AMERICANS are the average of nine complete separator tests on Pittsburgh Coal, conducted in our Testing Laboratory.

Other results shown are on authority of the Editor of Modern Mining, as given in article "Air Table Coal Cleaning Plant," page 223, Modern Mining, issue August and September, 1927.

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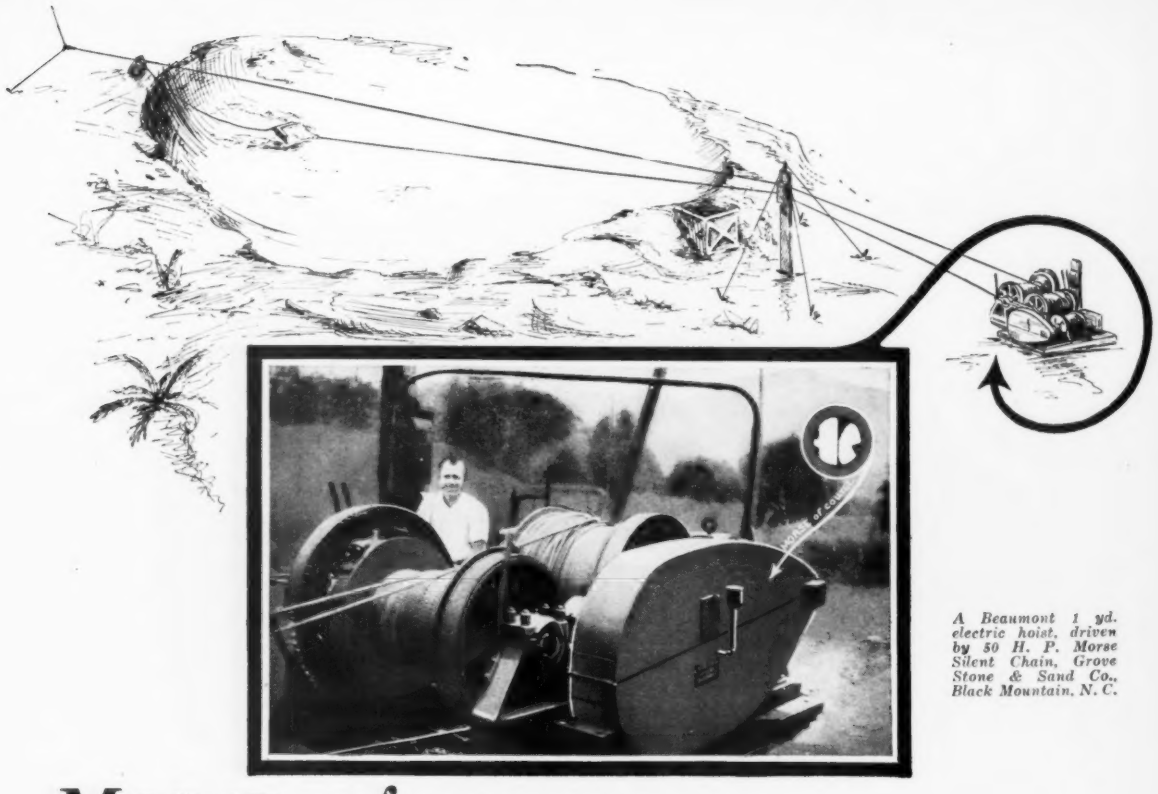

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